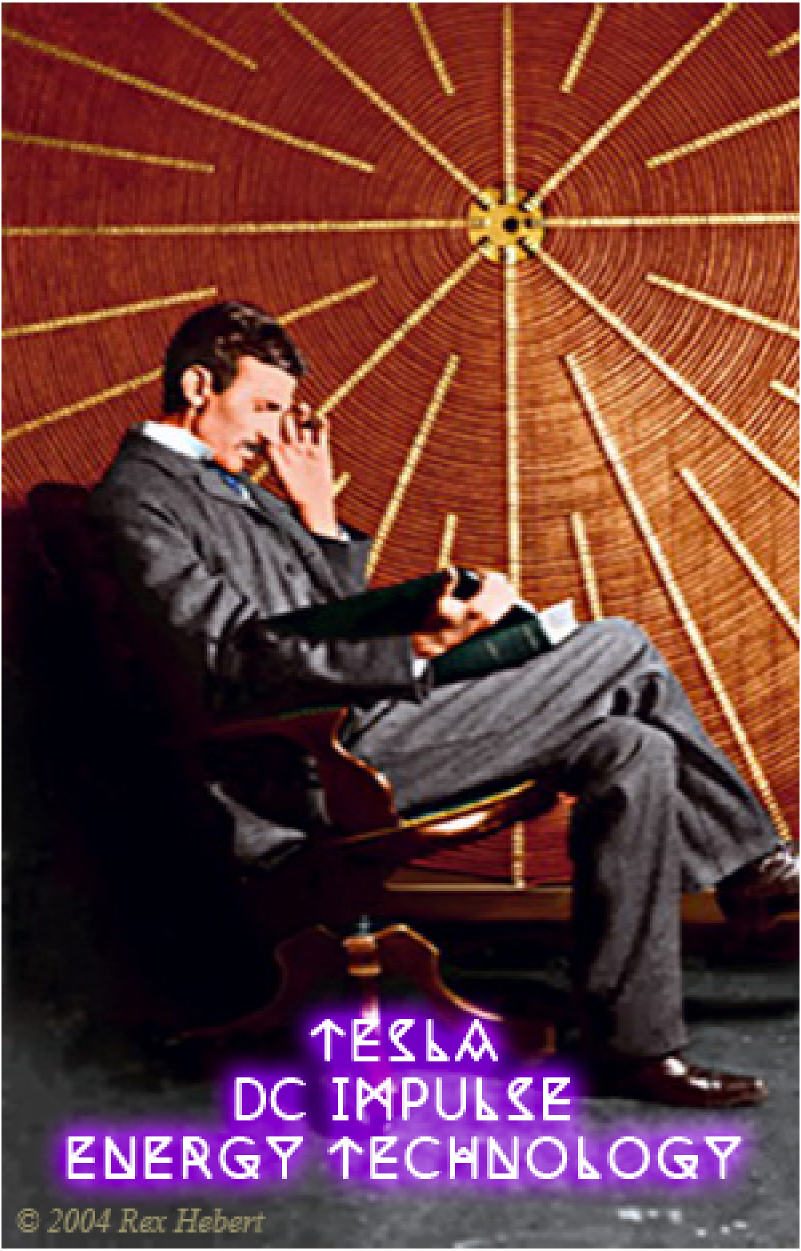

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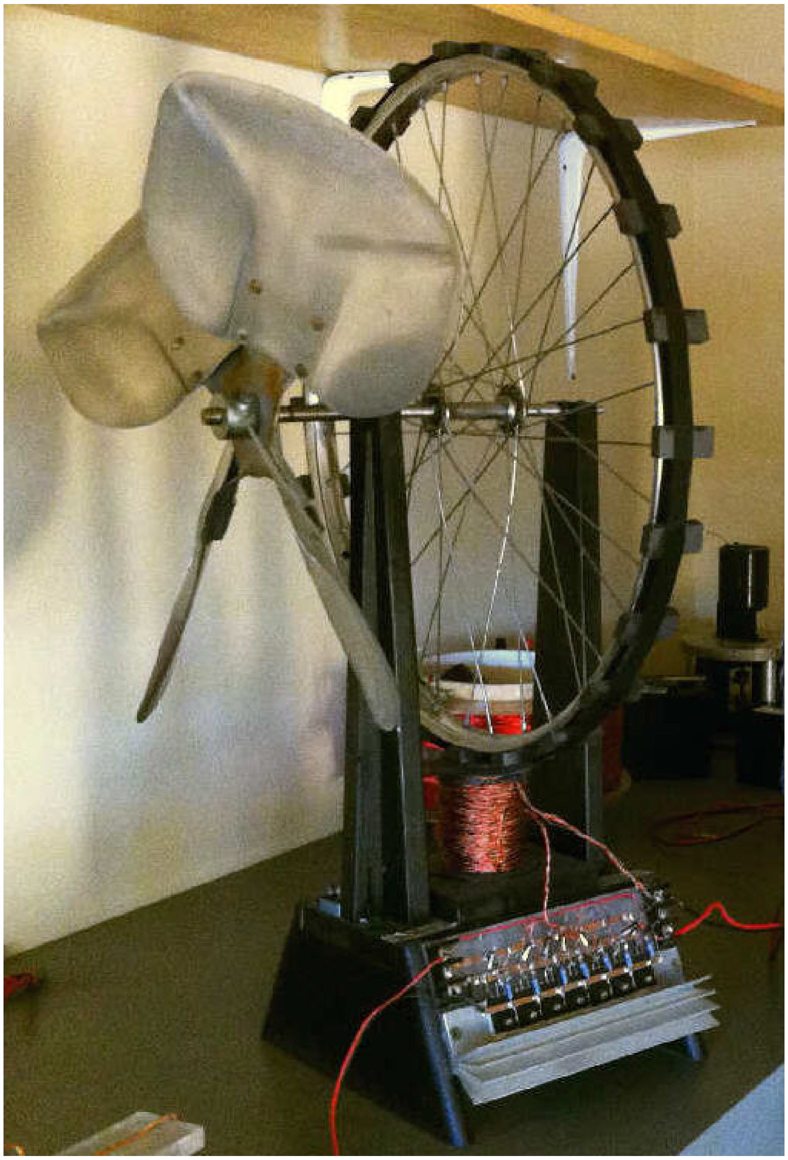
Bedini SG

The Complete Beginner's Handbook



* INCLUDES *
NEW DISCLOSURES
ON HIGH EFFICIENCY
RUN MODE!

Written by
Peter Lindemann, D.Sc. and Aaron Murakami, BSNH

Bedini SG

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Peter Lindemann, D.Sc.
and
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Adds clarification to a number of topics covered in the book, including "the direction of current flow" based on the convention used in the USA, the direction of winding the wire onto the coil and the different effects the clockwise and counter-clockwise methods produce, the difference between the repulsion and attraction "run modes," the wheel rim size and how it is measured, and the spool size for Shawnee's original science fair project, as well as correcting various grammatical errors.

Original Version 1.0 - Release Date November 27, 2012

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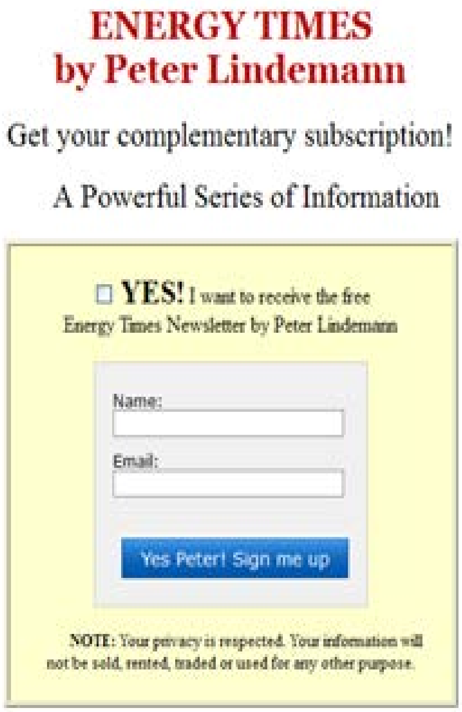

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Foreword

I've known John since 1983. Ever since that time, he has been working on perfecting a "self-running" machine. Over the years we went our separate ways, but reconnected in December of 2000. Then, in 2004, I had the good fortune of working at his company. We were focusing mostly on developing battery chargers, but his many models of "energizers" were all around the shop.

In 2004, at the urging of Sterling Allan, we started releasing the plans for his basic energizer. Since then, thousands of experimenters have built models and run their own experiments. Dozens of forums and discussion groups have spontaneously formed to support this movement. Eight years later, there is so much information in these forums, and so many advanced ideas mixed with the basics, that it has become time to publish a definitive and "Complete Beginner's Handbook" on this project, to help support new people just getting involved.

John was just too busy to write it himself, so Aaron Murakami and I volunteered to bring this all together. John has been through the whole manual, and says that everything is presented correctly. We have tried to present the information accurately, in a simple, easy to learn way. We believe that with the publication of this book, the "debate" about how this machine operates is over.

This book tells how to build it, how it operates, and what it does to increase the amount of energy available from Nature. Please do what John says… "don't change anything" until you've built it correctly the first time. Then, let it run, and learn what it has to teach you about energy transformation and energy conservation. But most of all, enjoy yourself, and have fun.

Peter Lindemann (November 2012)

Introduction

> "The only way of finding the limits of the possible
> is by going beyond them into the impossible."
> **Arthur C. Clarke**

John Bedini is one of the true "living legends" of the Free Energy movement. Starting from a very young age, John always wanted to build a self-running combination of an electric motor and an electric generator. Being told it was "impossible," even hundreds of times, did not deter him.

By 1984, John published his first book on the subject titled ***Bedini's Free Energy Generator***. In this book, John describes how to connect an ordinary electric motor to a specially designed "energizer" and switching circuit to produce a self-running machine that charges its battery while running. Multiple working models were shown at a "Tesla Conference" in Colorado Springs, Colorado in the same year.

This first success did not produce the results that John was looking for. The large model shown at the conference was built by Jim Watson. Immediately after the conference, Jim's machine was "confiscated" and Jim was forced to take a multi-million dollar "pay-off" to quit working on it. Shortly thereafter, John was "roughed-up" in his own shop and told he would "buy gasoline for the rest of his life, or else...." For the next 17 years, John continued to work on his ideas, but only built toy-sized models and rarely showed them to anyone except close friends.

Then in 2001, a very interesting thing happened. The father of a 10 year old school girl, who worked in a shop a few doors down from John's shop, came over to ask for some help with his daughter's science fair project.

Having an interest in helping younger folks learn about his technologies, John coached the girl, named Shawnee Baughman, on how to build a small energizer, based on his designs.

The energizer that Shawnee built ran on a little 9 volt battery for over a week, all the while lighting up an LED and spinning a rotor at high speed. She even had a series of posters explaining why it worked.

10-year-old Shawnee Baughman with her award-winning science

The machine absolutely infuriated the science teachers, because they could not explain why the battery was not running down! But the other teachers and students loved it, and she won "Best of Show" by popular demand! This was the advent of what became known as the "Bedini School Girl" energizer or the "Bedini SG" for short.

News spread fast around the older internet boards and Jeane Manning, a journalist and writer for Atlantis Rising magazine, wrote an article about Shawnee's energizer, including other details about John Bedini's energy technologies and experiences. This article was called ***The Attractions of Magnetism, Could a Little Child Be Leading Us to a Free Energy Future?***

(You can read this article in its entirety, as a copy of it is included in the back of this book on page 131.)

In the last 11 years, the Bedini SG has become the best known and most replicated Free Energy machine on the planet. For beginners in the field, it has become somewhat of a right-of-passage. Unless you have built one and learned what it has to teach, the nature of these discoveries will remain a mystery. It is quite simply THE project to start with.

Recently, John consolidated several of his energizer internet discussion groups into one new forum for people to visit and learn about his technology. You can visit or join this forum for free at http://energyscienceforum.com.

Although there is a huge data base of information on-line, where people can learn about this for free, a simple, authoritative book & video package has been requested for many years. The on-line forums contain a lot of experimental ideas and variations on a theme. But it is an awful lot of material to dig through. People getting involved for the first time now, just want to know how to do it right the first time. Hence, the release of this Complete Beginner's Handbook.

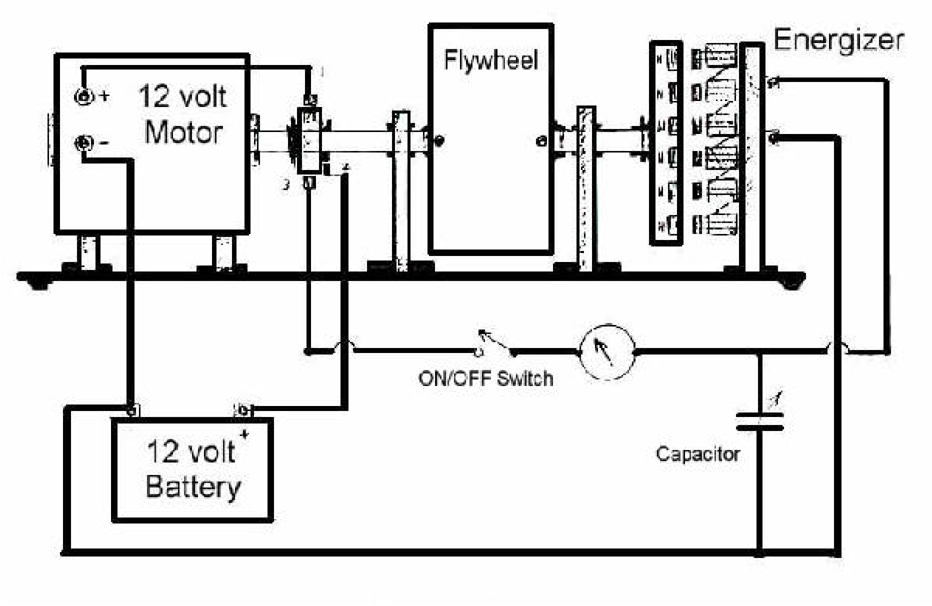
This book is what we all wanted to have in the early days. It explains the history, gives the schematics and parts lists, explains the theory, and reviews all of the variations of this amazing "do-it-yourself" project.
So, welcome to the club! We hope that the experience of learning about the Bedini SG is as rewarding and enriching for you as it was for us.

Peter Lindemann, D.Sc.
Aaron Murakami, BSNH

Chapter One

The Original "School Girl" Energizer

The design for John Bedini's first, successful, self-running machine was published in his 1984 booklet titled ***Bedini's Free Energy Generator***. It was a combination of an electric motor, a flywheel, a rotating switch, a battery, and a specially built electric generator he referred to as an "energizer."



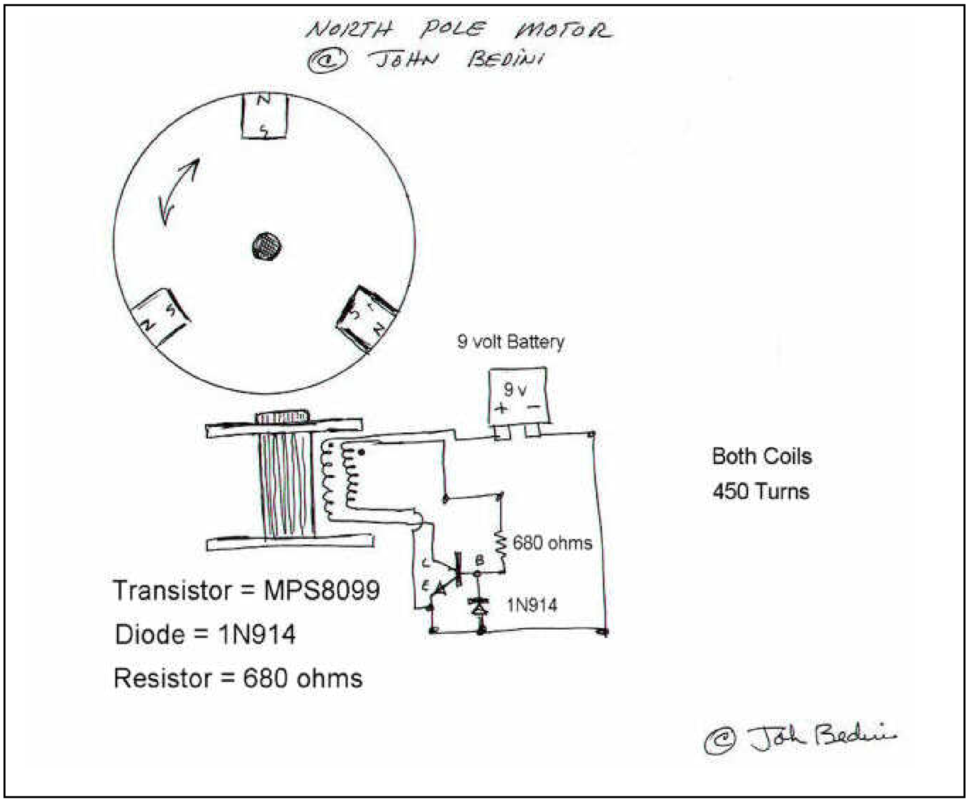
Bedini's 1984 Design

In spite of being threatened and told not to work on the technology, John continued to refine his ideas for the next 17 years. He understood that the secret of the machine was in the "energizer" and the switching method he had developed.

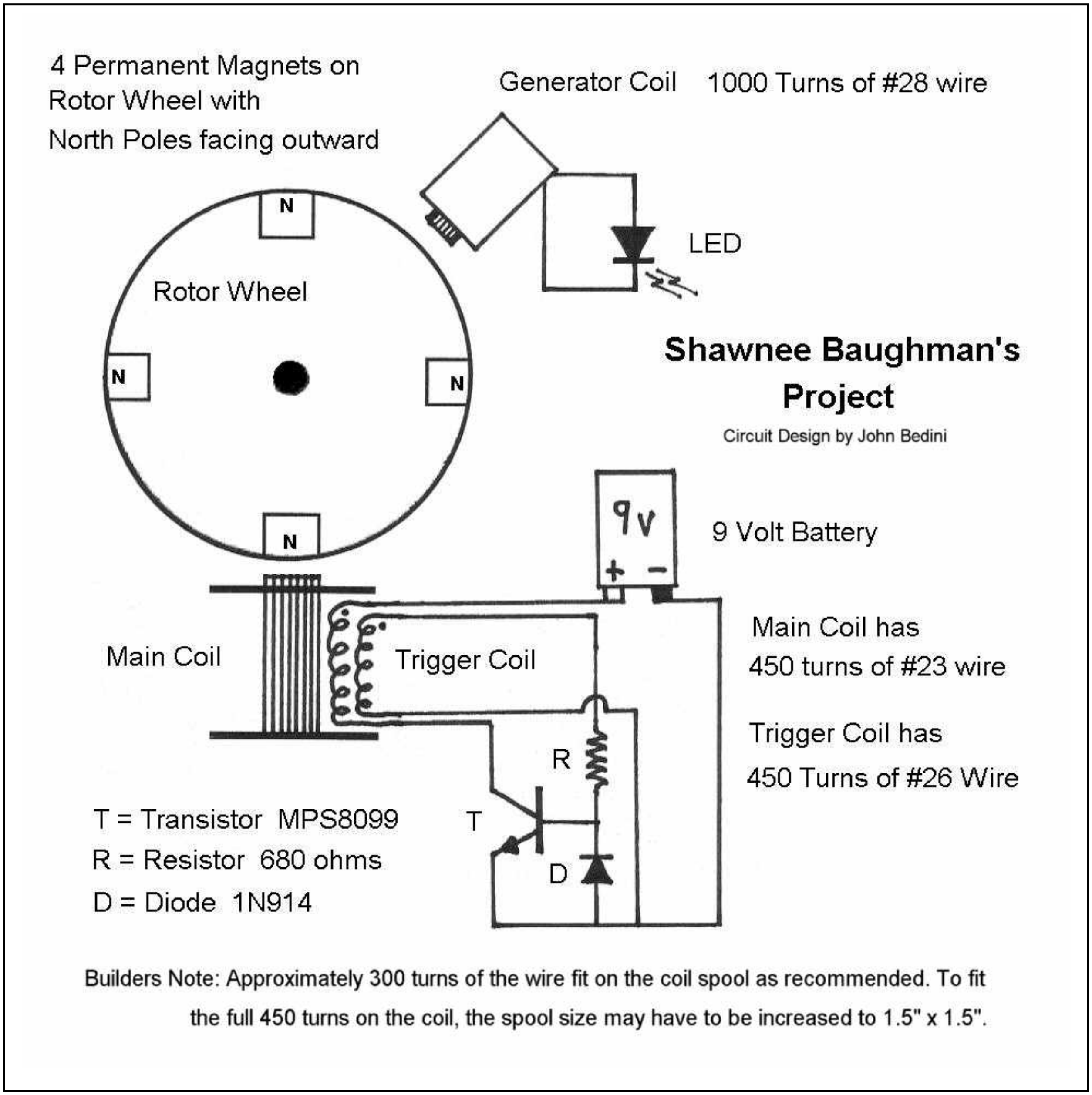
The energizer was a special generator that didn't slow down as much as a normal generator when electricity was coming out of it. The rotating switch allowed the battery to be charged part of the time, and then run the motor the rest of the time. As the years went by, John realized that if he could get the energizer to turn itself, he could eliminate the electric motor and really simplify the system. His experiments along these lines were very successful and by the time Shawnee Baughman came along, John had this new system working quite well.

The original energizer consisted of a wheel with a series of permanent magnets on it that would rotate in front of a number of coils of wire. As the magnets moved passed the coils, pulses of electricity would come out of the coils to charge the battery. But John also knew that the wheel could be made to turn if a pulse of electricity was put back into one of the coils at the right time. It was just a matter of developing the right switching method.

The new system consisted of an energizer, a battery, and a special timing circuit. That eliminated half of the components, including the electric motor, the rotary switch, and the flywheel. The new energizer consisted of a wheel with a few permanent magnets mounted on it, with one or two coils of wire mounted nearby. This is the system he taught Shawnee how to build. John called it the "North Pole Motor".



The only differences between his first drawing, shown above, and Shawnee's project were that Shawnee's rotor wheel had four magnets on it, and there was an extra generator coil mounted on the top that lit the LED.

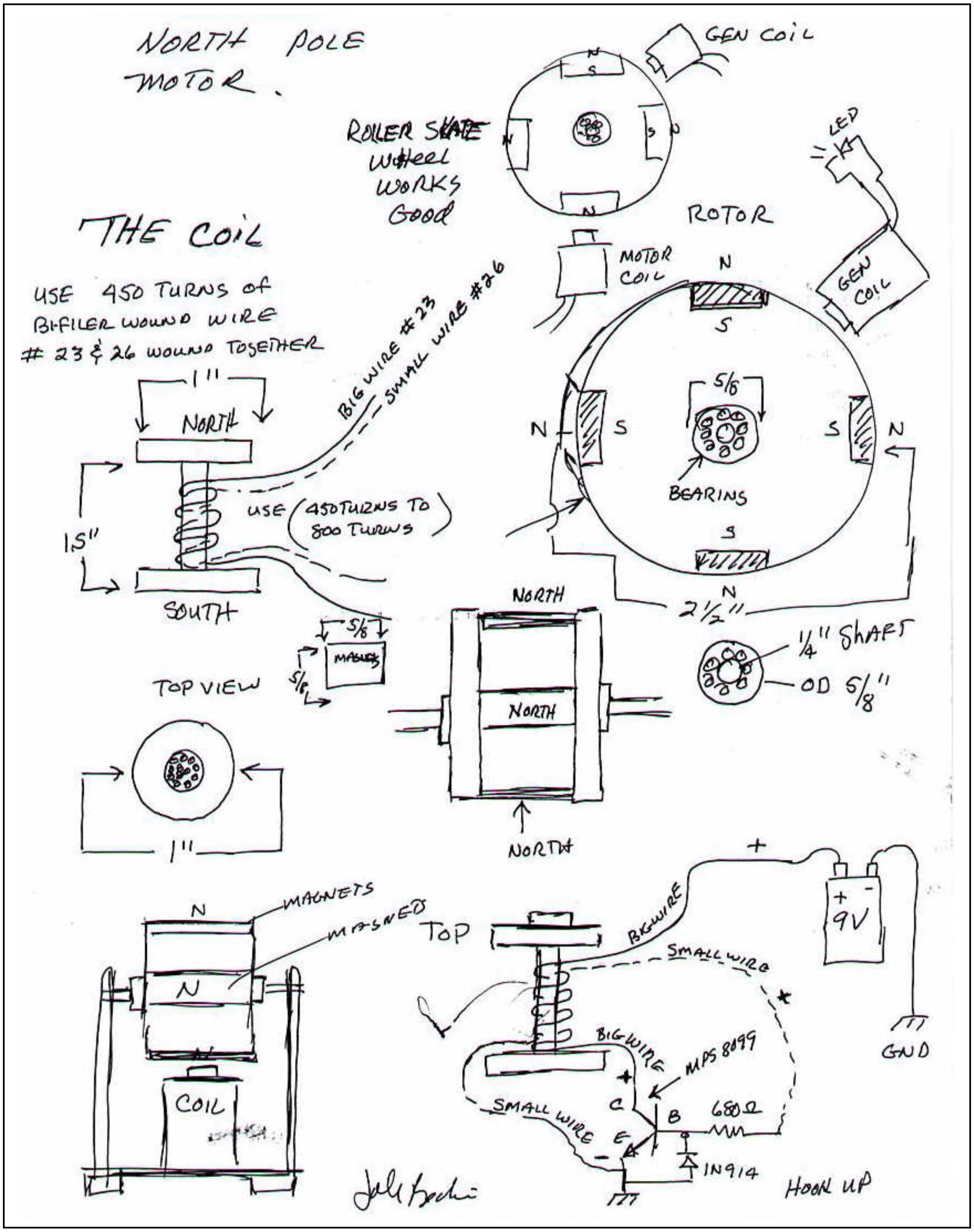


Builders Note: Approximately 300 turns of the wire fit on the coil spool as recommended. To fit the full 450 turns on the coil, the spool size may have to be increased to 1.5" x 1.5".

John gave her lots of pointers on how to take a roller skate wheel and mount it on a little stand. Then he showed her how to mount the permanent magnets to the wheel so they wouldn't fly off when the rotor was spinning. He also showed her how to choose the wire, wind the coils and add some little iron wires into the coils to focus the magnetism.

Finally, he showed her how to wire everything together, and even solder the electronic components together so they would work properly. John showed her what to do, but Shawnee built everything herself!

Here is a copy of the complete worksheet that John gave her.



As you can see, this is a fairly simple little project. It can be built using a little frame to hold a roller skate wheel that has 4 small permanent magnets glued onto it. It also has two small coils of wire, a 9 volt battery and four electronic components: a MPS8099 transistor, a1N914 diode, a 680 ohm resistor and an LED. The question is, what is so special about this device that a 10 year old could win a school Science Fair with it?

What is special about it is **what it does**! And what it does is run a very long time on the battery without the battery running down. In fact, it probably runs at least 20 times longer than any other type of toy motor, AND it also lights up a little LED light while it's doing it.

What upset the science teachers, who were supposedly "overseeing" the Science Fair, is that Shawnee Baughman, a 10 year old student, was demonstrating a reality in Science that they knew nothing about! She was showing how to power an "electric motor" and a little light (LED) from a battery in a way that, apparently, was NOT discharging the battery! At least, it was not discharging the battery as fast as the science teachers thought it should be discharging, according to what they knew about "electrical science."

Their dilemma was that the little demonstration was apparently breaking the "Law of the Conservation of Energy" and they didn't understand why. After all, 10 year old girls are not supposed to know more about science than the teachers do. What they didn't know, is that John Bedini had been working on this "little demonstration" for over 20 years, and he was quite far along in his research and discovery process.

Actually, the machine demonstrates a whole new way to "transfer" energy, as well as a way to "conserve" or recover all of the energy that was not actually lost, or "used up" in the process. In this way, it actually "conserves" energy better than ordinary machines.

Chapter Two

Why Does This Work?

Clearly, the science teachers were "out of their element," so to speak. They didn't have enough equipment to know for sure, but they did measure the battery voltage, and it just wasn't going down fast enough to account for how long the demonstration was running. The battery appeared to have more energy in it than it was supposed to.

Since it is, in fact, impossible to actually "break" any of the Natural Laws concerning how the Universe works, it is reasonable to ask:

1) How does the device operate?
2) What is the real energy balance of the machine's operation?
3) Is the machine demonstrating an "energy gain"?

Since this is a Handbook for beginners, there will be no attempt here to explain these processes in terms of established electrical engineering terminology, supported by mathematical formula. Rest assured, these exist. Instead, a series of illustrations with a verbal description will be presented which can be understood by enthusiastic hobbyists, as well as engineers.

The machine's operation does NOT break any rules which are well established in electrical engineering practice. It does break a number of ways that certain "Laws of Physics" have been generally interpreted, thereby demonstrating that these generally believed interpretations are not wholly correct. One of these is the "Conservation of Energy" rule.

John Bedini is a brilliant, yet classically trained electrical engineer and electronic circuit designer. He holds multiple patents on audio amplifier designs and holographic 3-dimensional sound processing methods, as well as advanced battery charging systems. The point is, he is a consummate professional engineer who routinely develops innovative solutions to complex engineering problems.

His development of multiple generations of "self-running" electro-mechanical machines is not an "accident." It is the result of decades of research and experimentation into "low drag" generator designs and how to charge a battery "very efficiently."

1) How does the device operate?

In order to clarify the operation of the "Self-Rotating Energizer" that John Bedini taught Shawnee Baughman how to build, I would first like to describe "what it is" and "what it is not."

Since the device operates on electricity and it mechanically spins during its operation, most people think of it as an "electric motor." To be perfectly clear, the device IS NOT an electric motor. John has always, from the very first, referred to the device as a "self-rotating energizer" or simply as an "energizer." This distinction is extremely important if you are to understand this project.

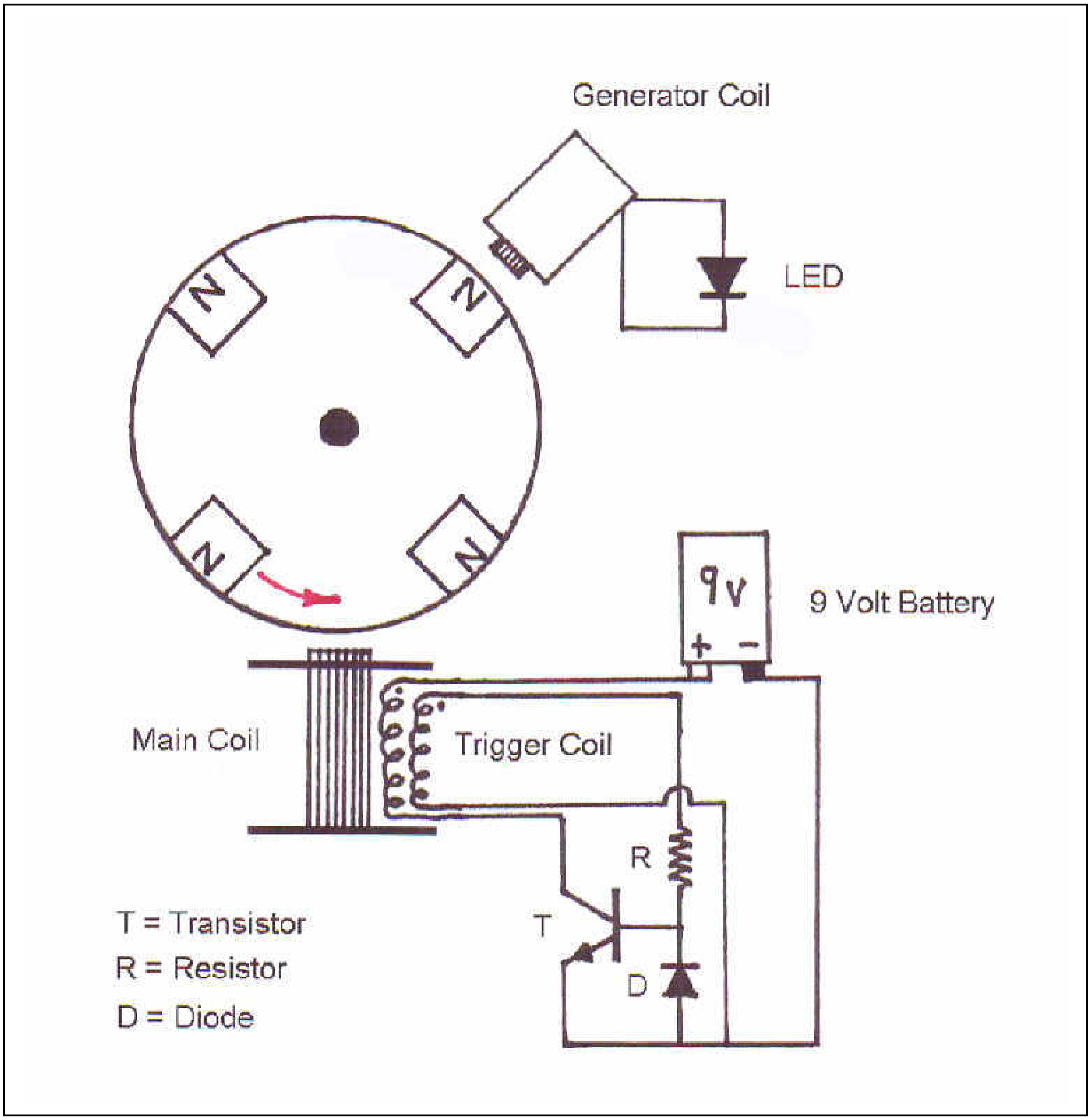
Electric motors are usually designed to power some other rotating device, like a pump or a compressor. This is NOT the primary purpose of the Bedini SG Energizer, as we will see shortly. It's true that it does spin and it does produce a small amount of mechanical energy. But the way it does this is very different than most electric motors and its ability to power other mechanical loads is quite limited.

The true purpose of the device is to have a very specific effect on the battery that is powering it, and to keep itself rotating! This is what it does.

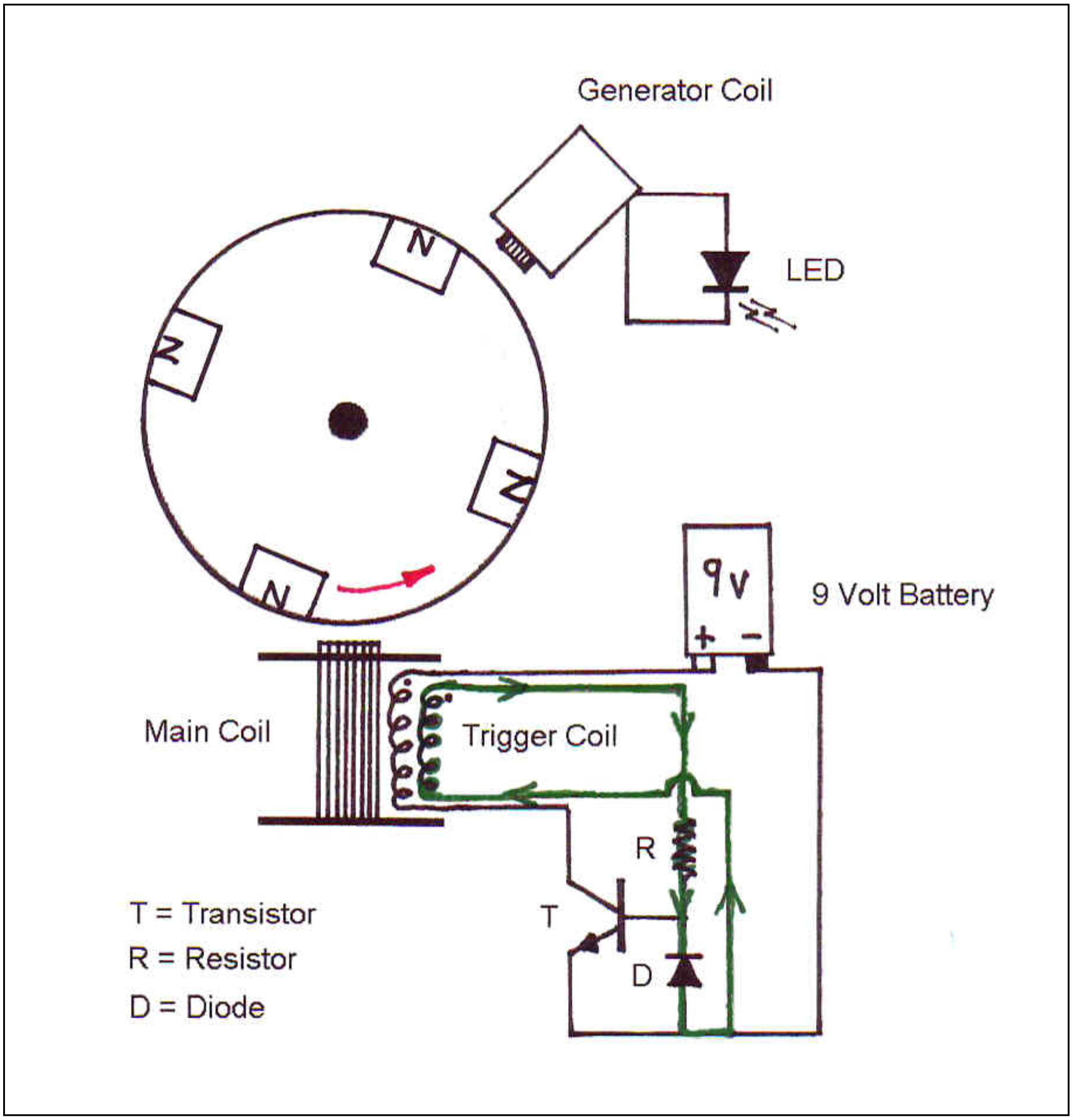
So, it is not an electric motor. Secondly, the model that Shawnee Baughman built is sized to simply "demonstrate" certain principles in electrical science.

In this sense, it is a "learning tool" and not a prototype for a "fuel-less power plant" that will power your home.

With this in mind, let us begin to understand how the device operates.

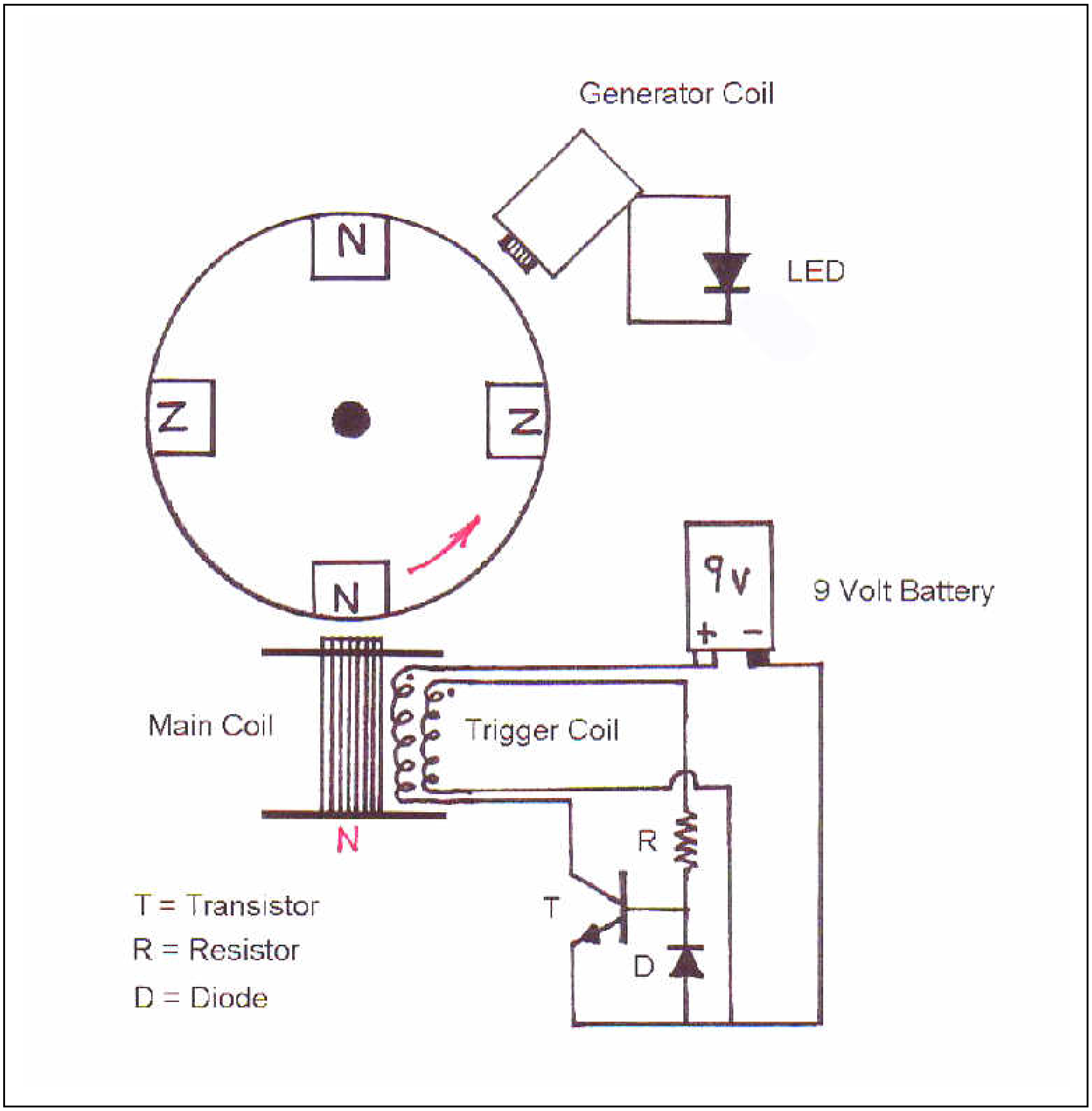


The Main Coil has some iron rods in the center of its structure and they participate in getting the process started. As one of the magnets on the wheel approaches the iron core of the Main Coil, it becomes attracted to the iron and so, it moves in the direction of the **RED ARROW**.

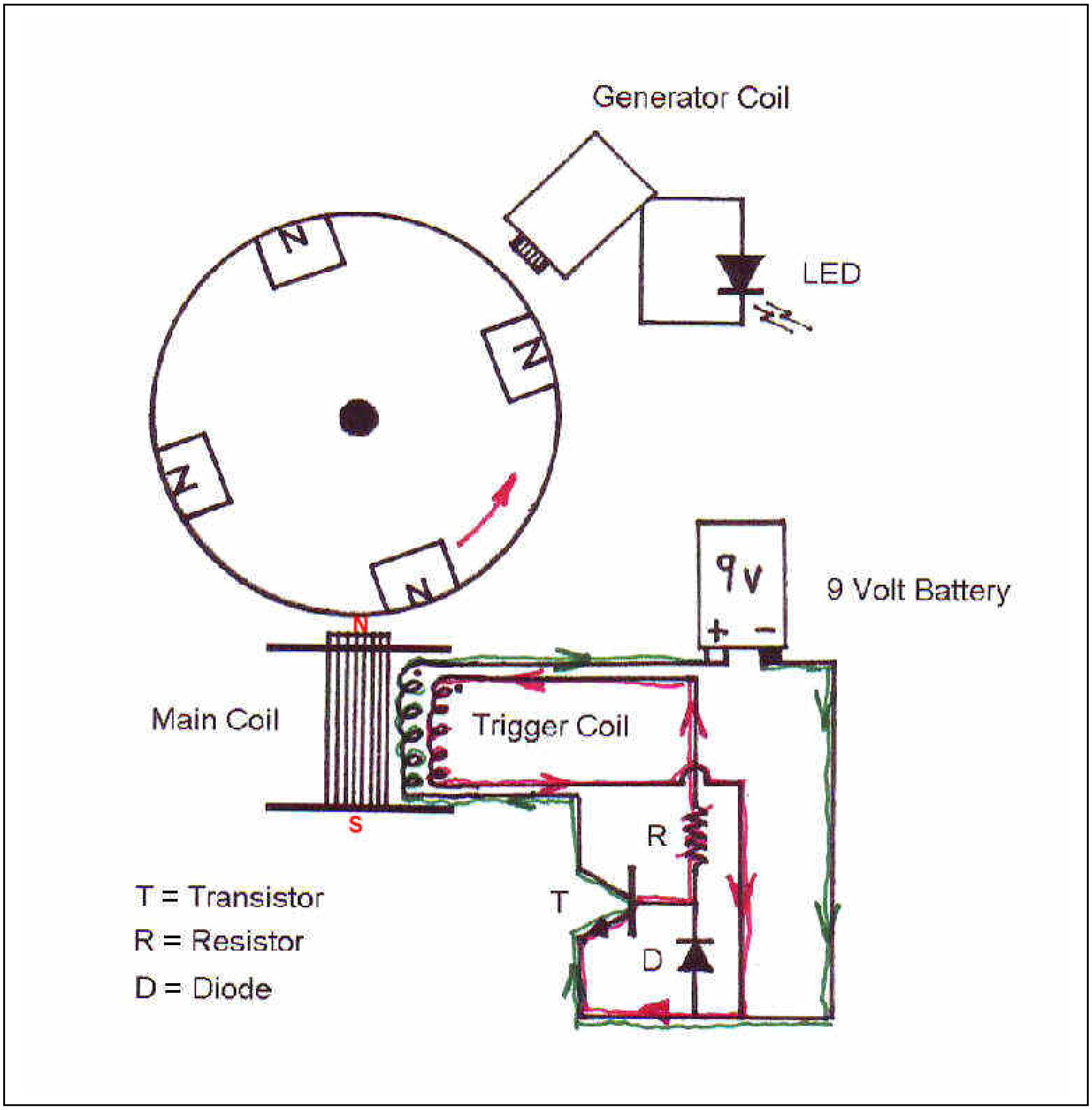


As the magnet gets closer and closer, the iron rods start to magnetize and as they do that, a small current is induced in the Trigger Coil winding that flows in the loop indicated by the **GREEN ARROWS**. With the coil wound "clockwise", this current flow is in the wrong direction to activate the transistor, so the transistor stays OFF during the approach of the magnet. This means that while the magnet is approaching the Main Coil, the transistor is OFF and no power is being drawn from the 9 volt battery.

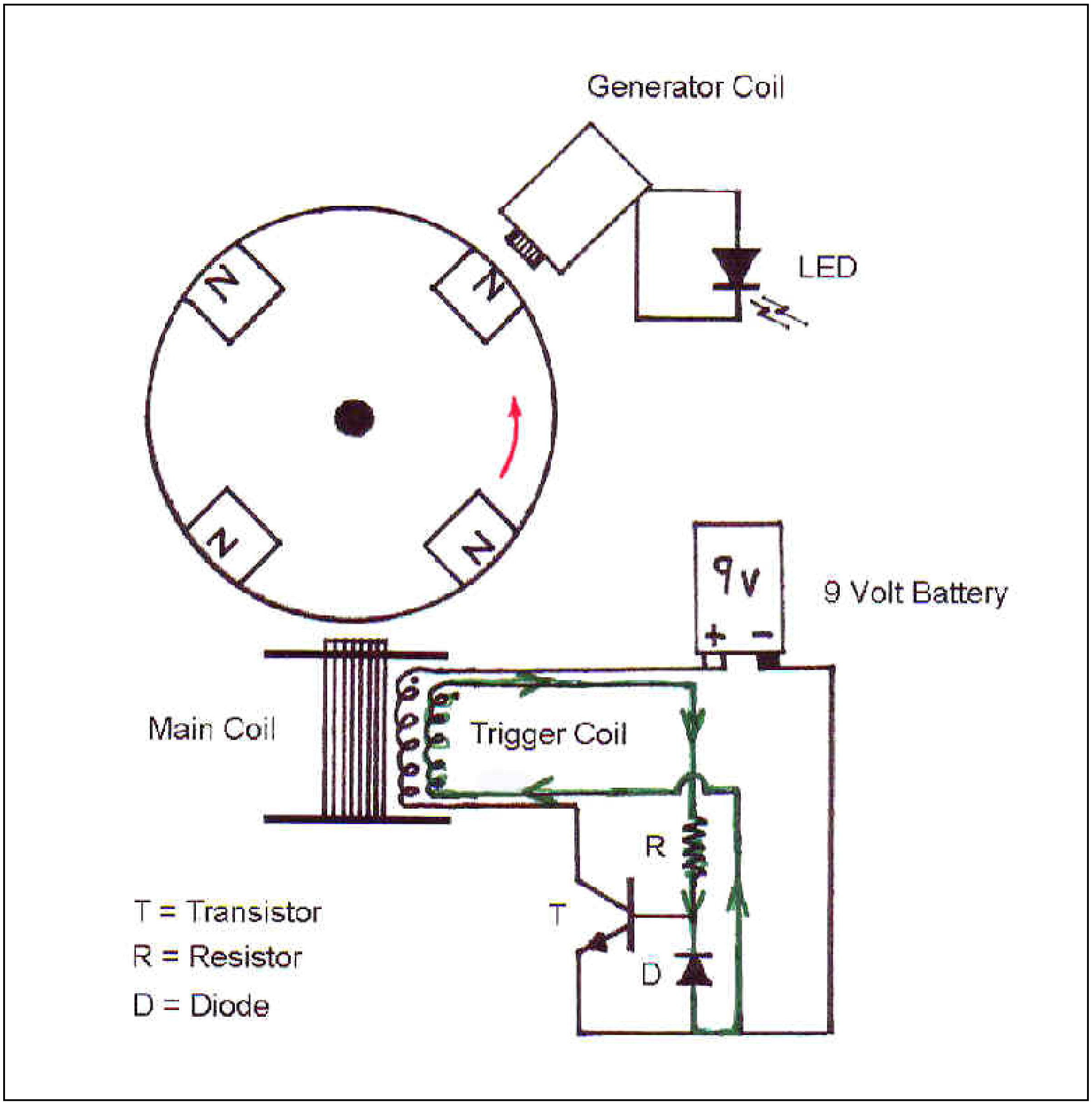
Mechanical energy is being produced and stored in the wheel, however.



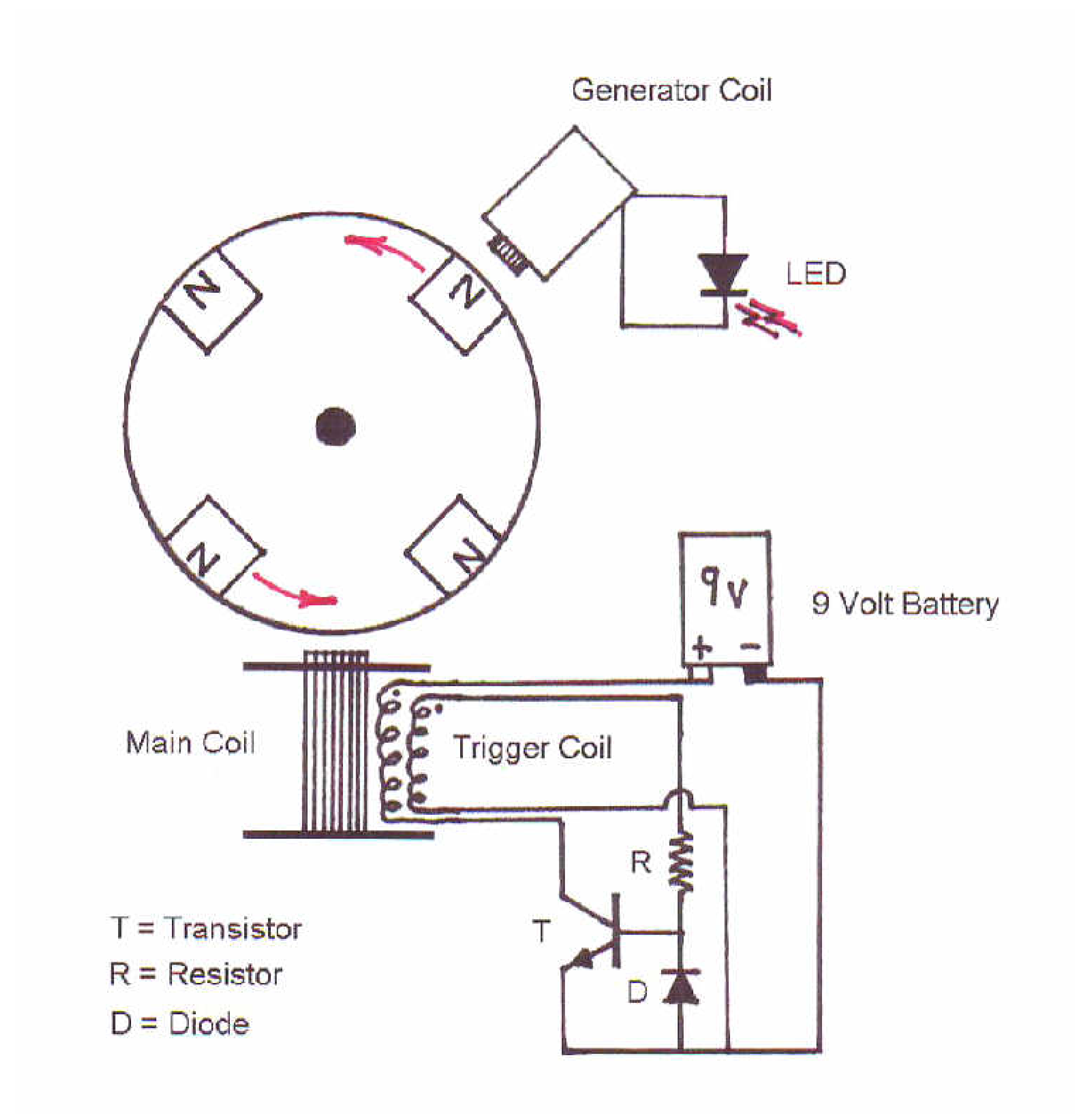
When the magnet gets to the position where it is directly above the iron core of the Main Coil, a number of things happen. First of all, the iron reaches its maximum level of magnetization, which has been rising steadily as the magnet approached. This "change of magnetic flux" is what has been inducing the current in the Trigger Coil loop. So, when the magnetization reaches its peak, the "change" of magnetic flux stops, and therefore, the current flowing in the Trigger Coil loop stops, as well. At this point, the magnet on the wheel has magnetized the iron in the Main Coil so that it is "attracted" to it. That means that there is an induced magnetic field in the iron with a South Pole facing the wheel and a North Pole facing down.



Now, the action really starts. The magnet on the wheel has been attracted to the iron and has stored some momentum, so it slips passed the alignment point with the iron core. Just as it does this, the magnetic field in the iron starts to drop, and that "change of magnetic flux" induces a current flow in the Trigger Coil loop that is in the opposite direction of what it was before, indicated by the **RED ARROWS**. This event now activates the Transistor to turn ON, causing a flow of current from the 9 volt battery to flow through the Main Coil, indicated by the **GREEN ARROWS**. The current from the battery now forces the magnetic field in the iron to reverse, so that its North Pole is now facing the wheel. This North Pole from the Main Coil now pushes the North Pole of the magnet on the wheel away, re-enforcing its established direction of rotation. This process continues until the iron core of the Main Coil reaches its maximum magnetization, based on the current flow from the 9 volt battery. At that instant, there is no more "change of magnetic flux" and so the induced current flowing in the Trigger Coil loop stops. This abruptly shuts off the Transistor, which in turn, stops supporting the magnetic field in the Main Coil, and so, the magnetic field must collapse and induce a current in the Trigger Coil, as indicated below by the **GREEN ARROWS**.

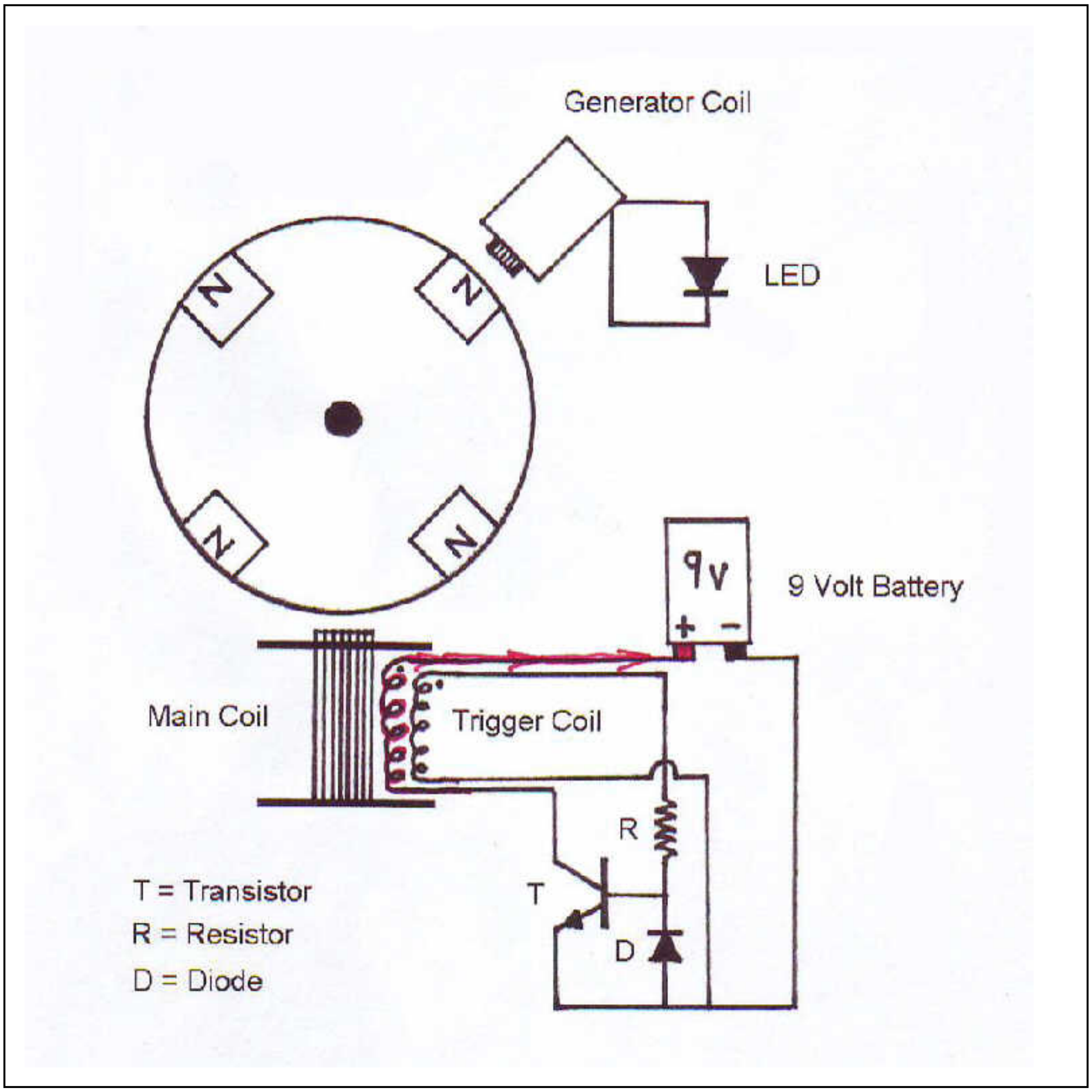


Meanwhile, the other magnet is approaching the generator coil, and is also being attracted to the small amount of iron there. As that magnet slips past the generator coil, a current is induced that lights up the LED for a single flash. As the rotor speeds up and these flashes happen more often, the LED appears to be ON all of the time.



At this point in the diagram, the cycle is about to begin again, but this is NOT the end of the explanation of the operation of this machine. Even though most "self-respecting" electrical engineers will be quite pleased to believe that everything has been explained already, the problem is that if this was all that was taking place, the demonstration would run for about 6 hours on the 9 volt battery. This is what the science teachers thought, and why they were confused when it ran for closer to 5 days!

So, the machine continues to run because the battery is being recharged by a process that has NOT been explained yet. Granted, everything explained so far IS HAPPENING and can be measured on test equipment. But there is ONE MORE thing that is happening that is much more difficult to quantify, and this is it.



When the transistor turns OFF, and even before the current starts to flow in the trigger winding to dissipate the energy of the collapsing magnetic field, a high voltage spike, consisting of a longitudinal wave of pure potential, travels from the Main Coil winding back to the positive terminal of the 9 volt battery along one wire. The event is over in a few microseconds, but its effect on the battery is profound.

It temporarily reverses the flow of the heavier ions in the battery, which apparently slows the average "discharge rate" of the battery by up to 95%! This allows the battery to run the "toy demonstration" for a much longer time than the battery normally would.

This phenomenon, first reported by Nikola Tesla in the 1890s, is called "Radiant Energy" and its appearance demonstrates aspects of electrical science that few researchers have understood. Lucky for us, John Bedini spent 20 years experimenting and teaching himself about this process until he understood it so well he could teach it to a 10 year old school girl.

2) What is the real energy balance of the machine's operation?

When measured by conventional methods, the "efficiency" of the machine is miserable! Production of mechanical energy is less than 20% of the energy measured coming from the battery. Energy available from the magnetic field collapse is dissipated in the Trigger Coil loop. All losses considered, an over-all 20% efficiency for the machine seems quite generous. This puts it "on par" with a gasoline engine, which is terrible! Actually, we'll discuss this in more detail in a later chapter.

3) Is the machine demonstrating an "energy gain"?

Not really, as described above. This is where almost everybody misses the boat. The "energy gain" is showing up IN THE BATTERY because of what the machine is doing to it. The energy gain is not measurable in the performance of the machine using conventional testing procedures.

Chapter Three

Optimizing Energy Recovery

Actually, "electrical science" is well aware of the little voltage spike that appears in a circuit when an energized coil of wire is disconnected from its source of current. This phenomena is generally considered to be:

1) a nuisance that
2) can damage electronic components in the circuit
3) unless it is gotten rid of somehow.
4) It is also generally believed to have no significant amount of energy associated with it, other than the "over-voltage" condition it may momentarily produce.

In this project, we will consider this little voltage spike to be:

1) of the highest importance to understand
2) and to take advantage of it
3) for the recovery of its real, yet under-appreciated, energy content.

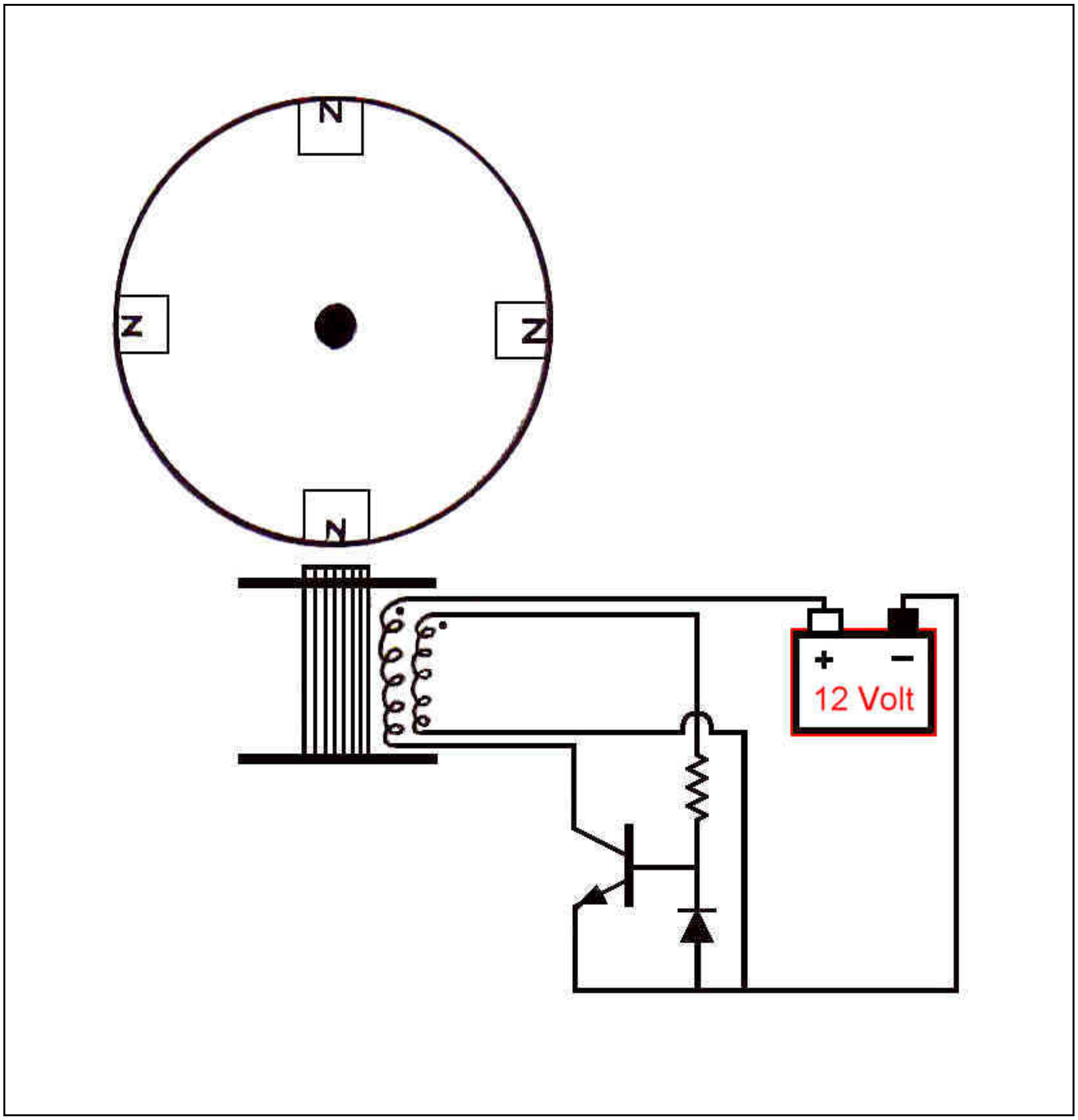
Except for this one difference concerning the significance and character of the voltage spike event, this project conforms to all other classical electrical engineering and circuit design methods. So, let's look at the energy recovery methods in this situation as we scale the project up to the next level.

Scaling Up the Electrical System

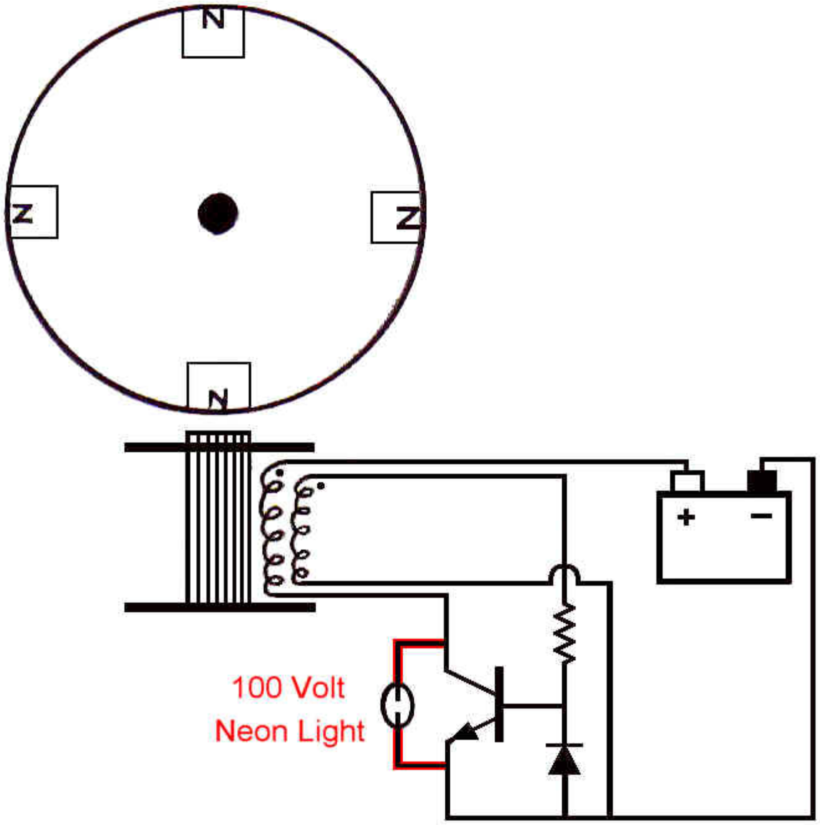
In Shawnee's model, the rotor wheel was about 2½ inches in diameter and the circuit ran on a 9 volt transistor battery. The Main Coil was 1 inch in diameter and 1½ inches tall. When the transistor turned off, the voltage spike was channeled back to the battery the model was running on to lengthen its run-time.

This process works fairly well at this size and with these components. But when you start making the Main Coil larger, the voltage spike event starts becoming much more difficult to manage. Instead of simply spiking the battery, it also tends to start burning out the transistor. In order to allow for these conditions and make larger models, the following changes to the basic circuit must be made.

The first change is to switch from the little 9 volt battery to a more powerful 12 volt, rechargeable battery.

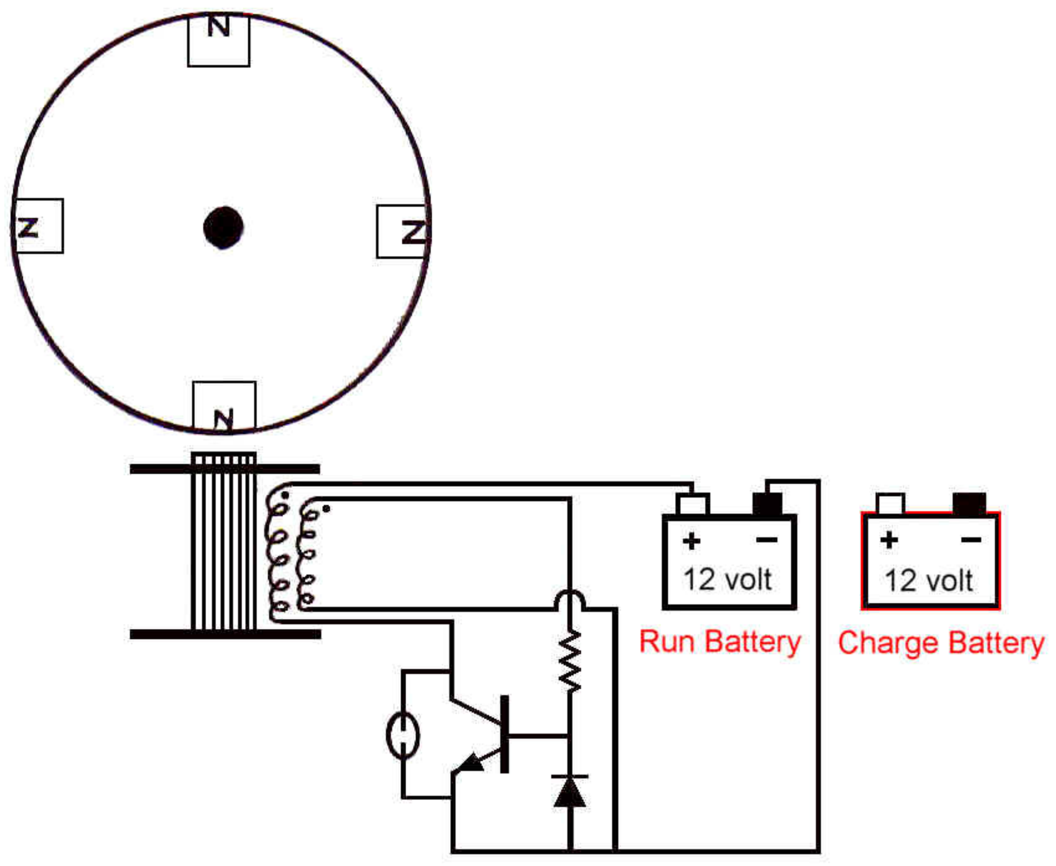


The next change is to ADD a component that protects the transistor, as a safety precaution, in case the voltage spike is not directed to the proper place. That extra component, in this case, is a NEON LIGHT bulb that completes the circuit if the voltage rises to about 100 volts.



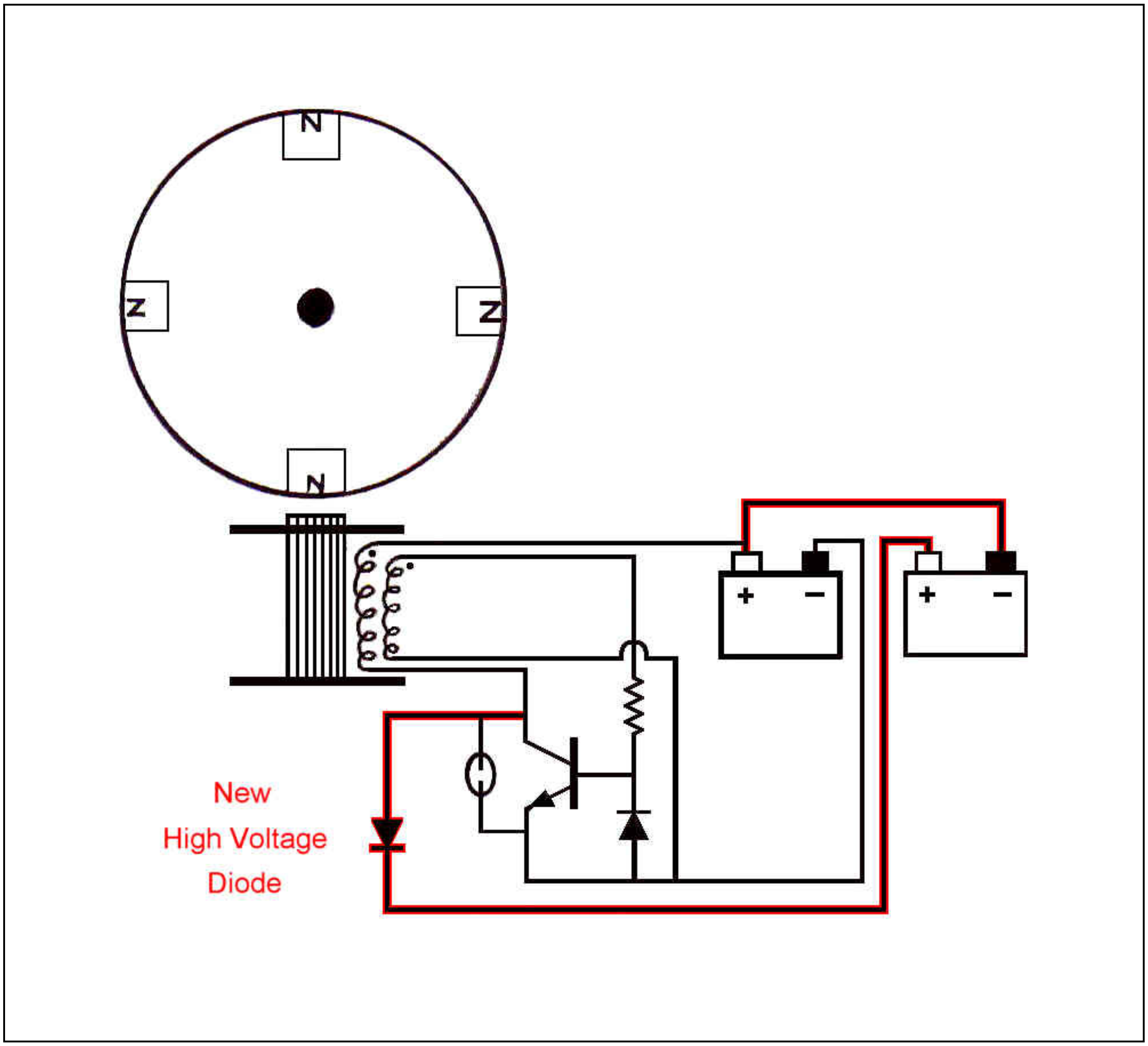
As you can see, the NEON LIGHT is placed directly across the output terminals of the transistor that is turning the coil ON and OFF from the battery. This way, when the transistor turns OFF, the voltage spike can create a temporary pathway back to the battery AFTER the voltage rises high enough to turn the NEON LIGHT ON. Otherwise, when the Neon Light is OFF, no circuit connection is being made.

The next change is to ADD a SECOND BATTERY to take best advantage of the Voltage Spike. You see, batteries don't really perform very well when they are being "charged" and "discharged" rapidly and repeatedly. So, the best way to take advantage of this is to RUN the machine from one battery, and to CHARGE a second battery with the voltage spikes.



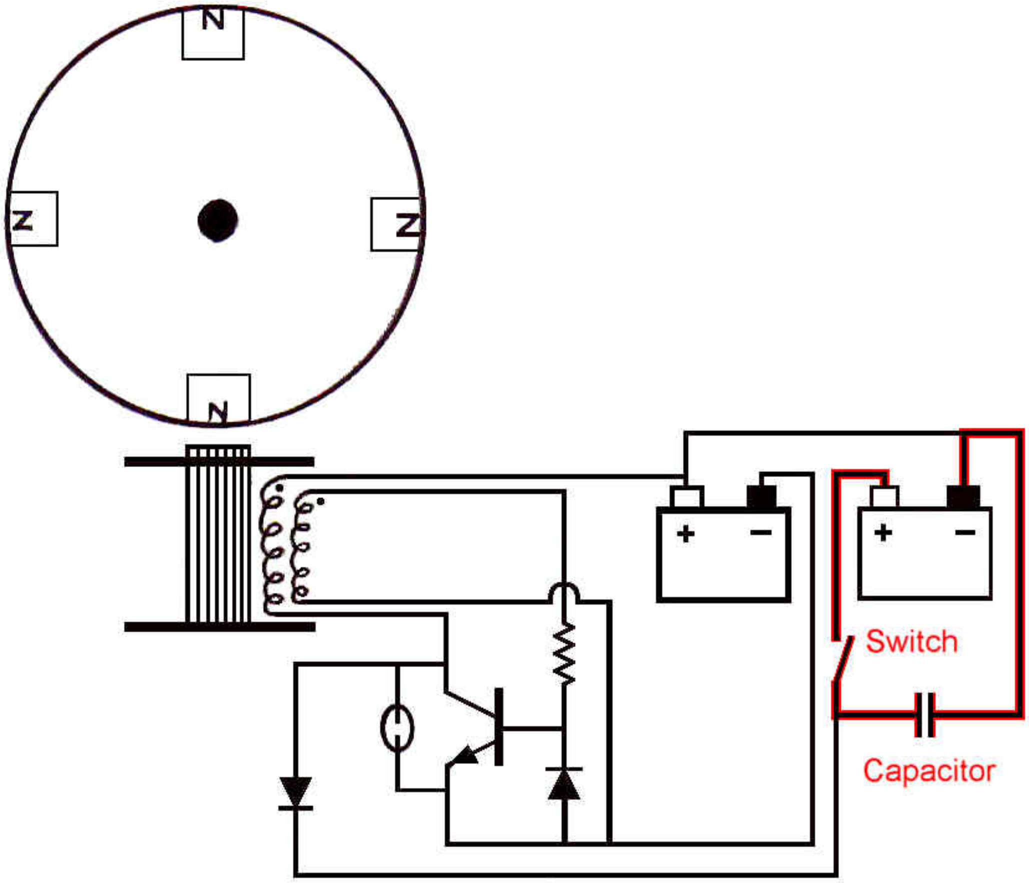
By adding a second battery to the circuit, one battery can now Run the system and the second battery can now be CHARGED by the system at the same time. This allows both batteries to operate at their highest levels of efficiency.

The next change is to ADD the extra wire to connect the new Charge Battery, as well as a NEW, High Voltage DIODE to direct the voltage spikes to this second battery.



The first diode in the circuit is needed to conduct currents in the trigger coil loop around the transistor when they were produced in the reverse direction. The new Diode must block currents from the second battery from discharging through the Main Coil. But it must also direct the voltage spike FROM the Main Coil back to the second battery whenever the Main Coil is disconnected from the RUN Battery after the transistor turns OFF. To do this without burning out, this New Diode must be rated for HIGHER VOLTAGES than the first diode.

So, this is the classic circuit for charging the second battery DIRECTLY from the discharges of the Main Coil. It works extremely well, but it also demonstrates an unusual phenomenon. Most Physicists and Electrical Engineers believe that all electricity is the same, and that electricity does NOT exhibit "quality" differences, only differences in quantity. In order to charge the second battery with a "quality" of electricity that is compatible with other methods of charging, one last modification must be made.



Here, we ADD a capacitor and a switch. Now, the voltage spikes from the Main Coil can be collected in the capacitor when the switch is open and periodically delivered to the battery when the switch is temporarily closed.

When all of these changes are made, it brings us to the quintessential Bedini Mono-Pole Energizer circuit that is extremely similar to the diagram shown in US Patent #6,545,444, issued in April of 2003. [A copy of this patent is in the back of this book, on page 89.]

In this chapter, I have purposely not given you any circuit component values or part numbers, because I want you to understand the basic circuit functions first. So this is the fundamental method of operating the self-rotating energizer and recovering as much of the electricity as possible. The circuit is stable and capable of safe operation with coils approximately 3½ inches in diameter and 4 inches high.

So this covers the section on the recovery of Electrical Energy in the machine. When the circuit is tuned properly, the CHARGE Battery is charging at about the same rate as the RUN Battery is discharging, so the system can run for a long time if the batteries are periodically switched.

Mechanical Energy Production

At this point, electrically, the machine is almost 100% efficient, primarily because of how well the CHARGE Battery is recovering its charge. But there is more! The rotor of the machine is spinning, and producing some mechanical energy, as well.

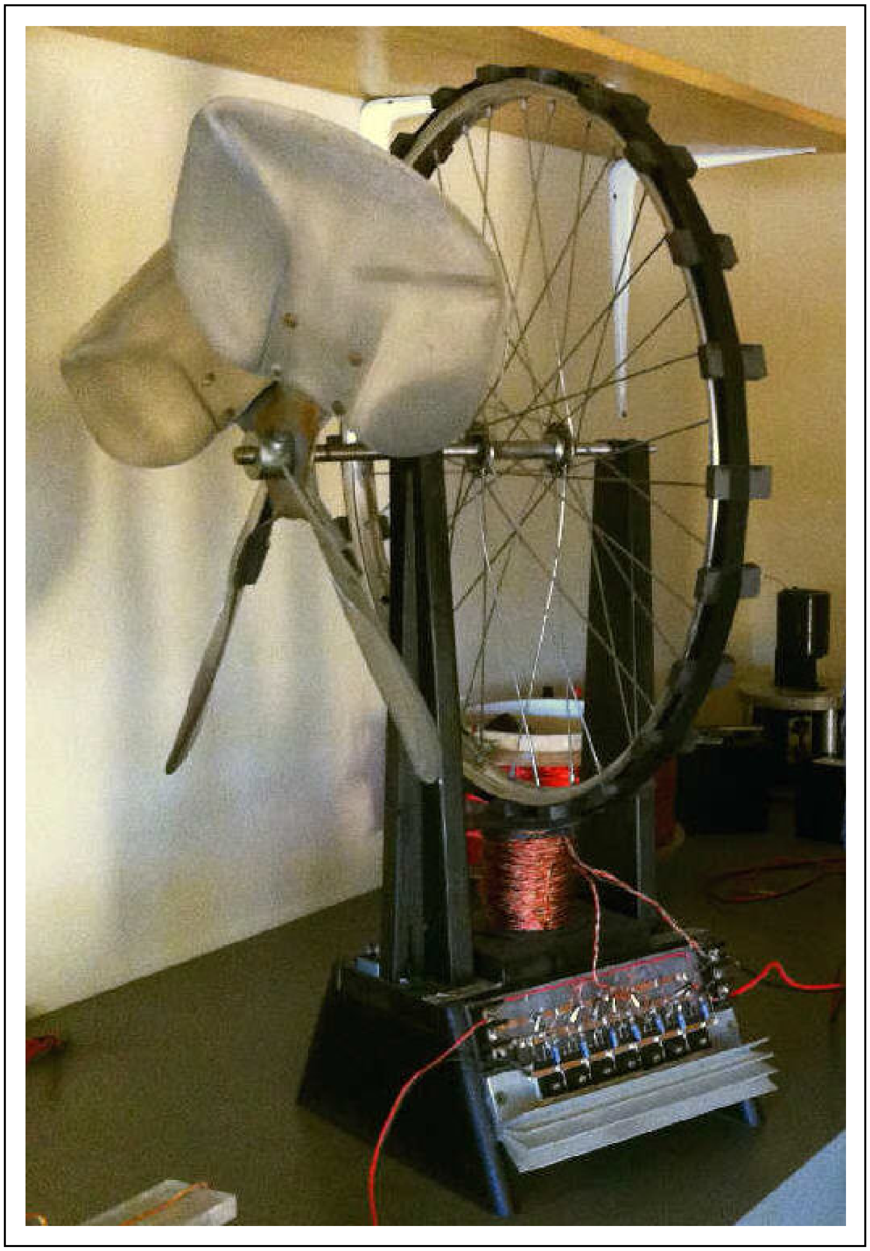
It is the combined electrical and mechanical energy outputs that exceed the electrical energy input.

So, what can be done to the machine to enhance its ability to make even more mechanical energy? As it turns out, there are a number of design features that can be changed to accomplish this.

For this Beginner's Manual, I'd like to focus on just two primary features, one is "rotor wheel diameter" and the other is "timing."

When I worked at John's shop in 2004, I tested every model he had with a dynamometer, to measure how much mechanical energy each model produced. Without fail, machines with the same electrical circuits produced more mechanical energy as the rotor wheel's got larger. The best one in the shop at the time was the model with the "bicycle wheel" rotor.

The other feature is the "timing." In other words, "when does the coil turn ON and how does it act on the rotor magnets"? This process will be discussed in detail in Chapter 6.



Chapter Four

Electronics 101 for the Bedini SG

You may have noticed that the electronic circuits that are a part of this project are expressed in symbolic form. This chapter of the book is for you beginners who are not familiar with the symbols used to produce a representation of the circuit, which is called a "schematic diagram." But this chapter is also used to explain the functions of the SG circuit, so please don't skip ahead if you think you know the basics already.

This chapter will cover just the bare necessities for you to work with this project. If you would like to learn more about electronics, at a beginner's level, I highly recommend the book:

Getting Started in Electronics, by Forrest Mims, which you can purchase from this website: Forrest Mims or by going to Amazon.com.

OK, let's get started. There are nine different electronic parts that have been used in the circuits discussed in the preceding chapters. They are:

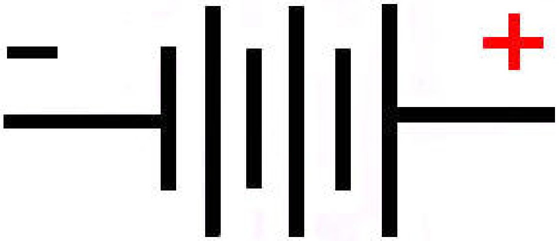
1. a Battery
2. a Coil
3. a Transistor
4. a Resistor
5. a Diode
6. a Capacitor
7. a LED
8. a Neon Light
9. a Switch

In the following nine sections, I will show you what each of these components looks like, tell you what it does in the circuit, and introduce you to its symbol, so you can understand how it connects to the other components.

The Battery is the source of electric power used by the circuit. While the original Bedini SG built by Shawnee Baughman used a small 9 volt alkaline battery, all of the models you will be working with will use a rechargeable lead-acid type of battery. These can be sealed, like a "gel-cell" battery, or the more typical type of openable cell batteries, like you may use in your automobile. We recommend that you use the lead-acid type of battery that has openable cells like the one illustrated here.

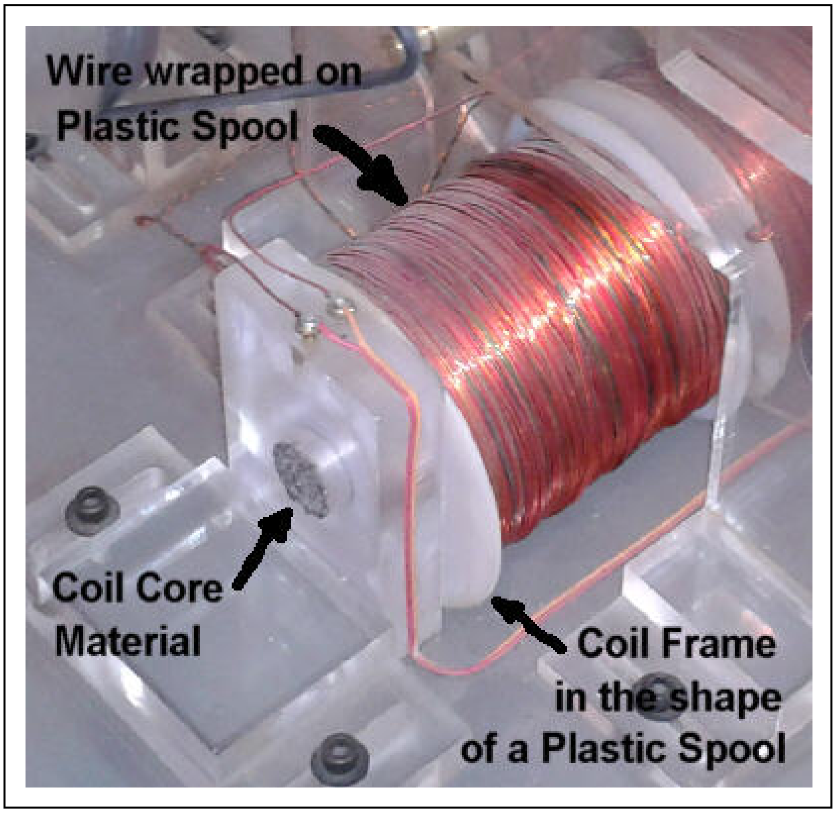
The reason for choosing a battery like this is that they are more difficult to damage when you are learning experimental charging methods. They are also relatively inexpensive and can run your experimental energizer for between 12 and 24 hours at a time.

The symbol shown here is how a battery is indicated in a schematic diagram. The parallel lines indicate the battery plates. The short lines represent the Negative Plates and the long lines represent the Positive Plates of the battery.

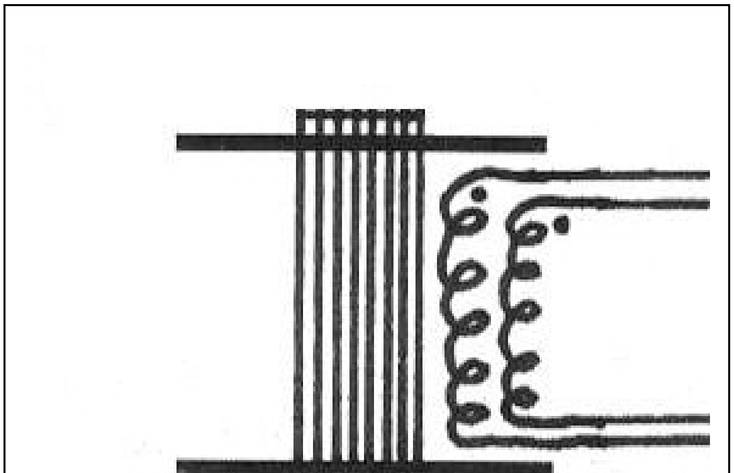


Symbol for a Battery

The Coil is the component in the circuit that produces a magnetic field when electricity flows through it. It consists of a plastic coil frame, sometimes called a "spool", one or more lengths of wire wrapped around this frame, and a material in the center of the frame to channel the magnetic field.


Wire wrapped on Plastic Spool
Coil Core Material
Coil Frame in the shape of a Plastic Spool

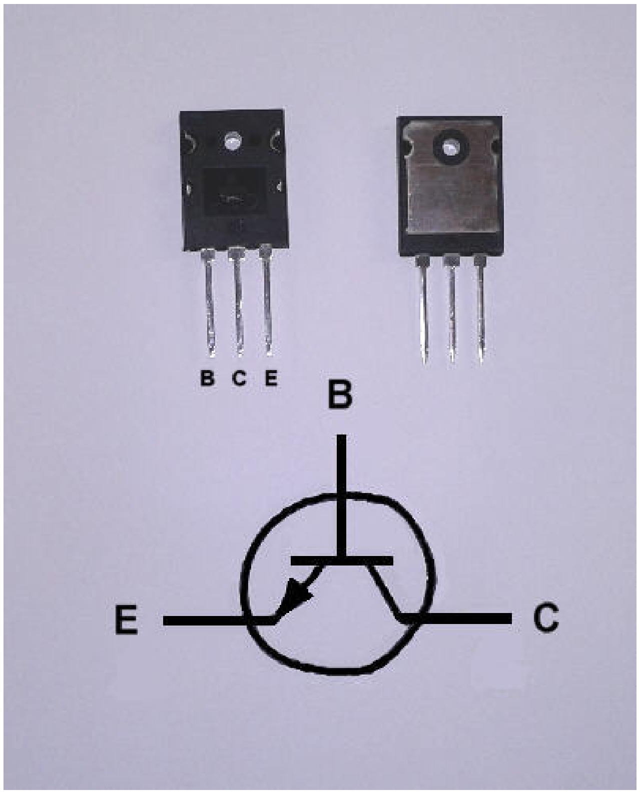
The coil frame is quite often in the shape of a "spool" with an open center section. This way, wire may be wound around the outside of the spool and held together by the plastic disks on each end, while the open center may be filled with a material that will channel the magnetic field. Here we see an image of a coil illustrating these features.



Symbol for Wire Coil

Here is the symbol for the Coil element in a schematic diagram. You can see the three features, including the Frame, the Core in the center, and the Wires, which show the turns symbolically as little squiggles. The dots near the top of the coils indicate that these are the same "ends" of the coil for two separate windings.

The Transistor is a "semi-conductor" device that has a complex function to regulate the circuit. Actually, it connects two parts of a circuit so that one part can regulate what the other part is doing. In this case, we are using the Transistor as a "switch" that has no moving parts, something that can turn the electricity ON and OFF when we want it to. [Transistors can also be used to perform other more complex functions, such as amplification.]

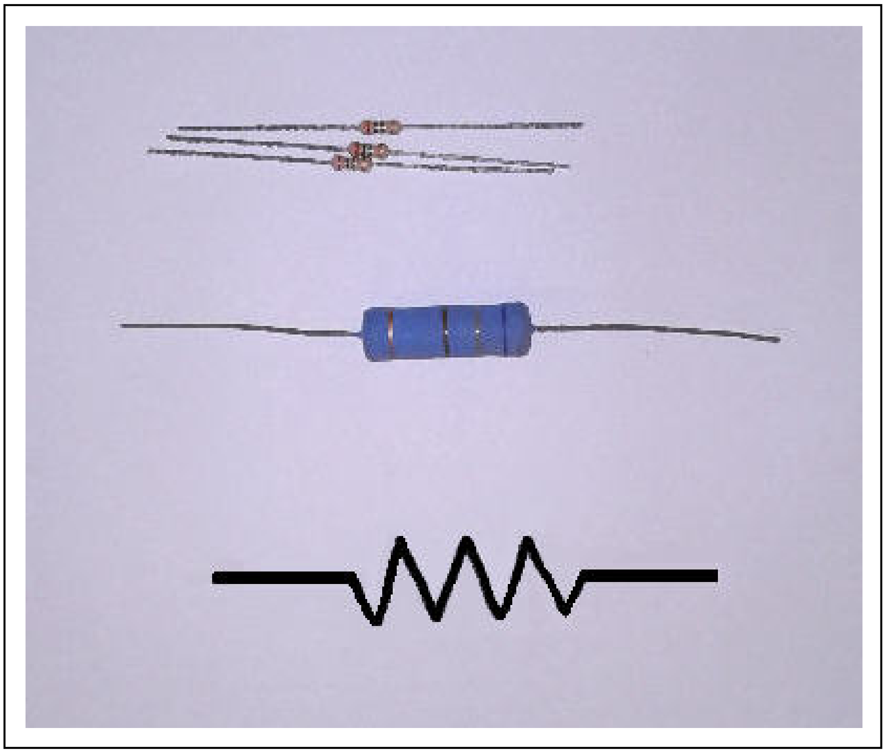


This image shows a typical "power" transistor from both the top and the bottom. As you can see, it has a square "case" with a mounting hole near one end. It also has three connections coming out that all must connect to the circuit. The symbol to the right shows these three connections, and labels them B, C, and E. These letters stand for the Base, Collector, and Emitter.

There are thousands of different types of transistors that perform hundreds of different kinds of functions in different circuits. The kind shown here, and the kind we will use for this project, is an NPN Bi-polar Junction Transistor.

In use, the transistor in this circuit will be acting like an ON/OFF switch. The Emitter is connected to the Negative of the Battery, the Collector is connected to the Main Coil, and the Base is connected to the part of the circuit that tells the transistor when to turn ON and when to turn OFF. Exactly "how" the transistor performs these functions is beyond the scope of this tutorial. You may find that information in the ***Getting Started in Electronics*** manual recommended earlier.

The Resistor is a passive component that regulates how much electric current moves through that part of the circuit. It has two connections fitted to either end of a cylindrical body. It can be hooked up to the circuit in either direction.



Resistors come in hundreds of sizes and are rated for the amount power flowing through them, as well as for their resistance to current flow, which is rated in units called Ohms.

The symbol for the resistor is shown as a wavy line that resembles the teeth of a saw blade.

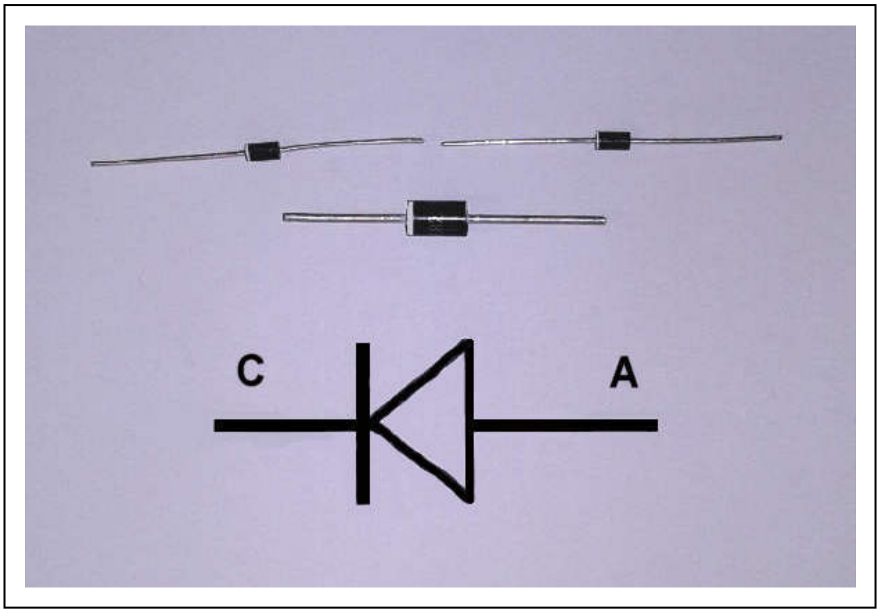
The three small resistors shown at the top of the picture are typical ¼ watt resistors, used in many electronic devices. You may be able to see some colored stripes on them. These stripes represent a code which reveals the resistance value of the component.

The larger blue resistor is a typical 2 watt device. Its color code, starting from the right side is blue-yellow-brown-gold. This means that the resistor has a resistance value of 640 Ohms, and is guaranteed to be within 5% of that value.

This last gold line is the one that represents the 5% "tolerance" value. Many electronic components have these tolerances ratings, because it is impossible to mass produce components that have exactly the same values.

The Diode is a component that only allows electricity to flow ONE WAY in the circuit. It acts like a valve that is open to electricity flowing in one direction, but if it tries to go backwards, the valve shuts and prevents the electricity from coming back. It does this with no moving parts, using a special semi-conductor junction, like ½ of a transistor.

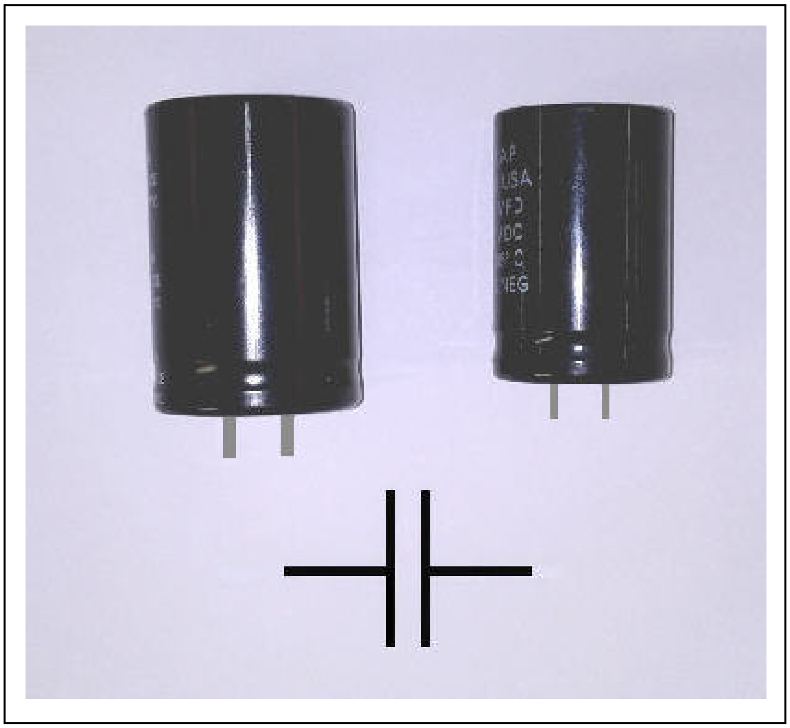
Because the diode passes electricity in one direction and blocks it in the other direction, it is very important to install diodes in a circuit correctly. Whereas Resistors operate the same in both directions, Diodes do not!



Diodes usually appear as a small cylinder with a wire coming out of each end. Diodes will usually show the symbol, or a single stripe at one end of the cylinder, as the examples in the picture shows. One end of the diode is called the "Cathode" (C) and the other end is called the "Anode" (A). Electricity will flow through the device when the Cathode is "more negative" than the Anode, OR if the Anode is "more positive" than the Cathode. The stripe indicates the Cathode end of the Diode.

The symbol for the Diode looks like an arrow pointing at a solid line. Remarkably, the direction of flow of electricity through the Diode is in the opposite direction of this arrow. The reason for this is that the symbol for the Diode was invented when it was believed that electricity flowed from Positive to Negative. After it was discovered that electrons have a Negative charge, and their flow was really from Negative to Positive, it was too late to change the symbol. So, **electron currents** flow through the Diode in the opposite direction of the way the arrow is pointing.

The Capacitor is a component that stores electricity. Whereas a battery stores electricity in a chemical form, the capacitor stores the electricity as an electrical stress across a material called the "dielectric." Because no chemical changes have to happen for electricity to move into or out of a capacitor, it means that a capacitor can be charged and discharged very quickly, almost instantaneously, in fact.



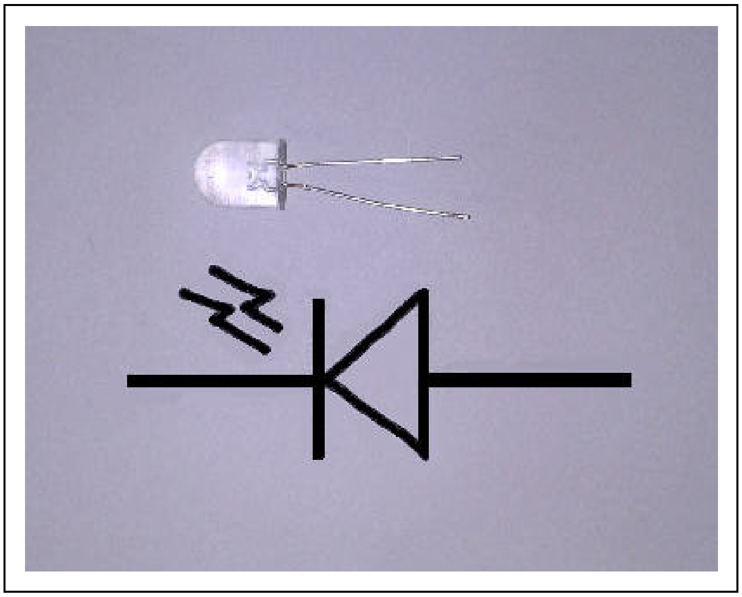
Capacitors come in many shapes and sizes, from as small as a little resistor, all the way up to the size of a garbage can. These two capacitors are about one inch in diameter.

The symbol for a Capacitor is two parallel lines facing each other, with wires coming out. These parallel lines represent the "plates" of the capacitor and the space between the lines represents the dielectric material that separates them. So, a typical capacitor has two contacts and connects to a circuit in two places.

Capacitors are rated both for how high a voltage they can store, but also for how much energy they can store, which is called "capacity." The capacity of a Capacitor is usually rated in units called "microfarads", although very large devices are now also rated in "farads."

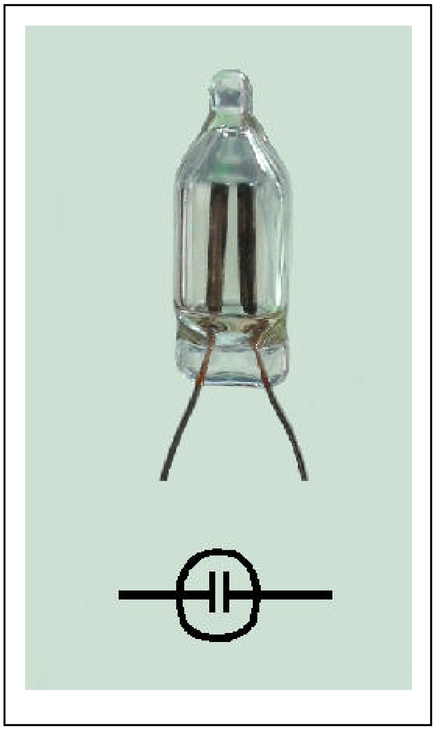
Some Capacitors are "polarized", like a Diode, and need to be connected to a circuit in the right way. Others are not polarized and can be connected to a circuit in either direction. Polarized Capacitors are usually marked with a stripe on the negative terminal or on the side of the label.

The LED (Light Emitting Diode) is a special diode that works as a light source. Actually, most semi-conductor junctions produce some light when they operate, but LEDs are designed to maximize the light producing function.



The symbol for the LED is the same as for a Diode, except that it also has two little squiggly lines next to it, indicating that light is coming out of the diode.

Like all other Diodes, the LED only allows electricity to move through it in one direction. And, like all other Diodes, the LED has a Cathode and an Anode and must be connected to the circuit correctly to operate.

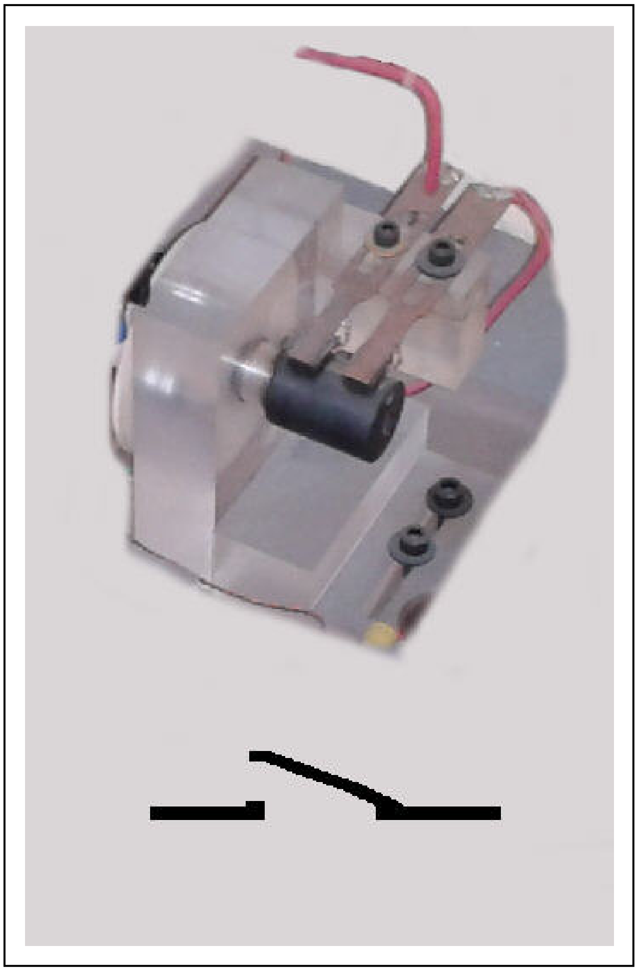


The Neon Light is a specialty lighting device where two electrodes are placed near each other in an enclosed space that contains a small amount of Neon gas at very low pressure. It usually takes about 100 volts to make a neon bulb light up.

The symbol for the Neon Light mimics its internal structure, where two parallel electrodes are surrounded by an enclosure.

Neon Lights can run on either AC or DC and are rated for both the voltage needed to light them up, as well as for how much power they use, measured in milliwatts.

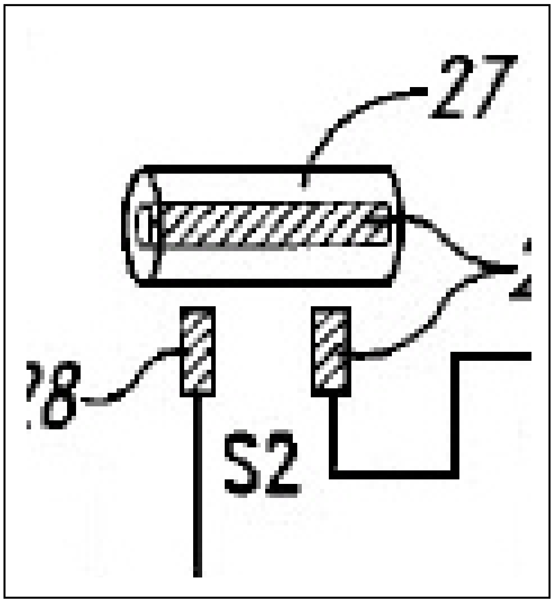
The Switch is any device that allows a temporary contact between two sections of a circuit. Most of us use switches everyday, to turn ON appliances, lights, fans, stove elements and other things. We even have many automatic switches that turn things ON and OFF based on pre-set conditions, like the thermostat in our house, or the refrigerator and freezer.



In the Bedini SG Project, the Switch is used to discharge the Capacitor into the Battery after it has been charged to a certain level by the discharges of the Main Coil.

The generic symbol for a switch is the one shown here, where a wire is interrupted with a section connected to one end and the other end is hovering over the wire. This represents a break in the wire that can be closed to complete the connection.

To the right is an image taken from John Bedini's US Patent #6,545,444. It shows the same roller wheel and two brush contacts in symbolic form as the top picture shows as a real model.

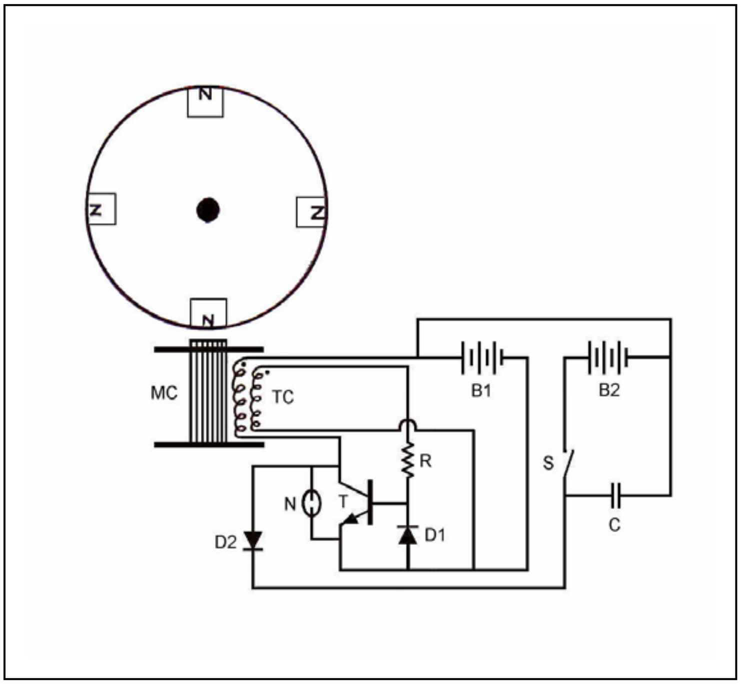


So, anything that works to make a momentary contact, periodically, will discharge the Capacitor into the Battery and keep the system operating.

Reading a Schematic Diagram is pretty easy, once you understand how circuits are laid out. In general, circuits usually have at least three parts. They are best described as Power, Control, and Output.

The Power section of the circuit consists of a "power supply", and the part of the circuit that power is being supplied to. The Control section of the circuit is the part that tells the power section "what to do" and "when to do it." The Output section delivers the results of the other two sections.

An example of a circuit is a home music system. The Power comes from the wall plug and is converted into the power needed by the circuit. The Control function starts with the music signal stored in the recording and transfers it to the power section. The Output is the speaker system where you can listen to the music at a controllable volume.



So here is the schematic diagram of the simplest form of our project. Notice, I have used the symbols I talked about earlier in this chapter and labeled each component with a simple letter, or letter and number designation. All of the lines that connect between the labeled components represent wires.

So, let's review the components of this circuit.

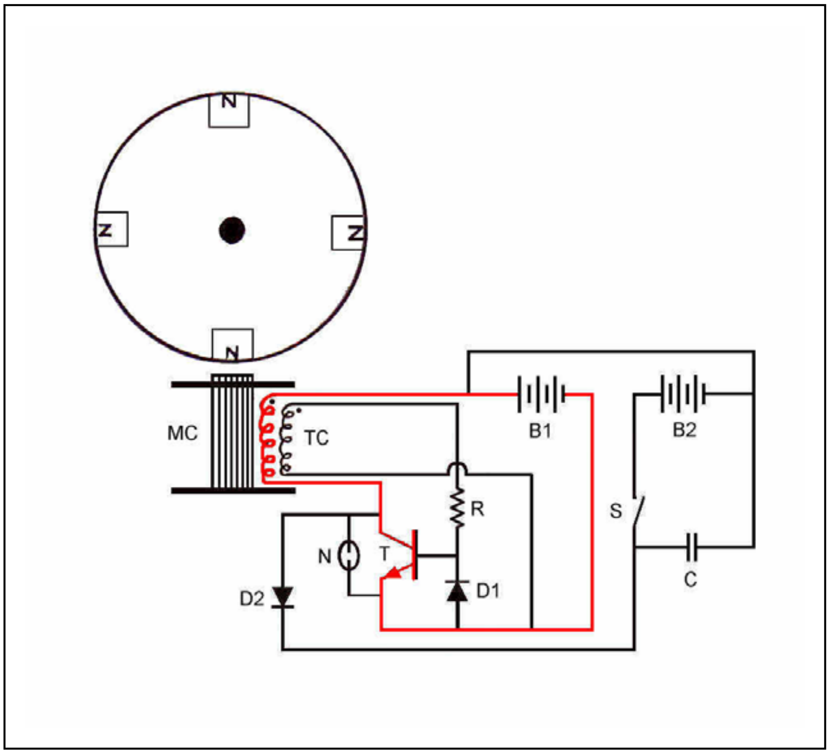
B1 is the "first battery" or the battery the system runs on. It is the beginning of the circuit, and functions as the "primary power supply." When trying to figure out how a circuit works, always start by trying to identify the power supply first. B2 is the "second battery" or the battery the system charges. Since this is the end result of the circuit, B2 also represents the Output, and in this case, the actual end of the circuit.

The other components include the Transistor (T), the Resistor (R), Diodes (D1 and D2), the Neon Light (N), the Capacitor (C), and the Switch (S).

OK. Let's look at the **Power Section** of this circuit. We have already identified B1 as the power supply, and the beginning of the circuit. So, what does the "power supply" supply power to? In this case, it supplies power to the Main Coil (MC) through its connection to Transistor (T).

In the diagram below, I have highlighted this section of the circuit in **RED**. Tracing the flow of electron current from the Battery (B1) we see that it flows out of the Negative terminal, follows the wire to the Emitter of Transistor (T), comes out the Collector of Transistor (T), follows the wire up to the bottom of Main Coil (MC), flows through Main Coil (MC) and comes out the top, then follows the wire back to the Positive Terminal of Battery (B1).

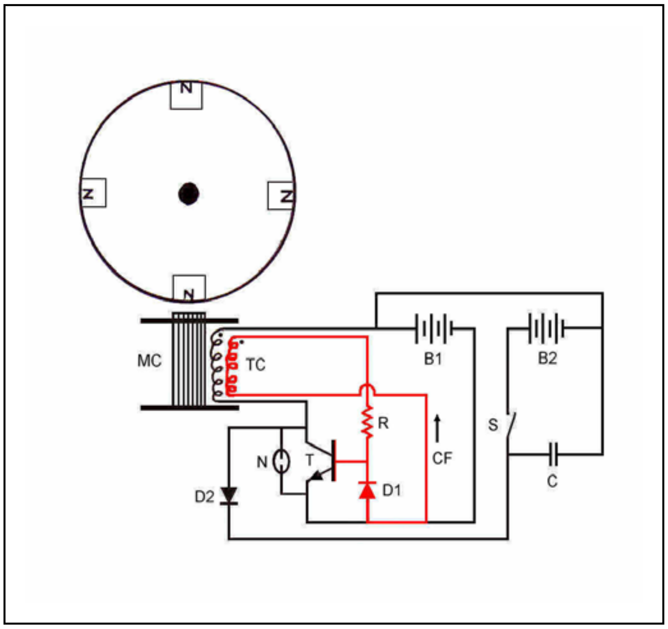
Read the paragraph above and look at the drawing of the circuit diagram to the right until you understand that they represent exactly the same set of ideas. If you are having trouble with this, please refer back to the earlier descriptions of the battery and the transistor.



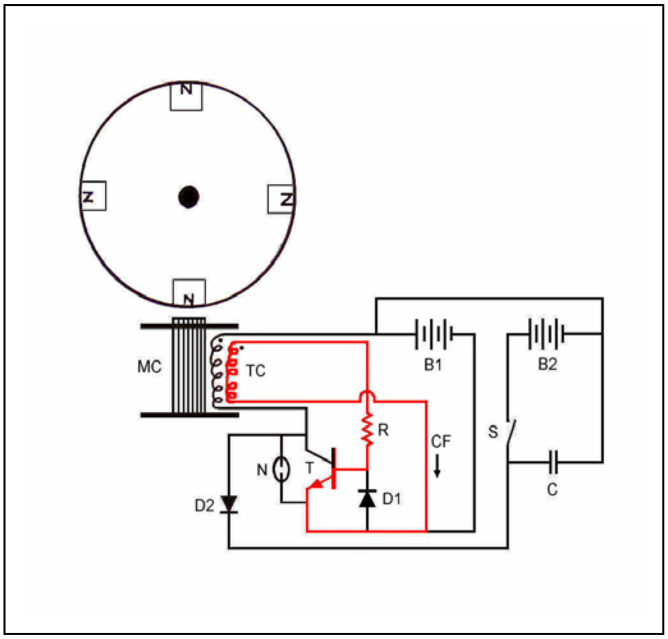
This is the power section of the circuit for this project. When this function happens, the Main Coil (MC) is being magnetized, and the magnet on the rotor wheel is being pushed away. It is the only time when electricity is coming out of Battery (B1) and the only time when the system is consuming any energy that counts as an "input."

Even though this is the Power Section of the circuit, it too has the three main functions of Power, Control and Output. The power comes from the Battery (B1). The Control is provided by Transistor (T), and the Output, or the end effect, is the production of a magnetic field when the electric current flows through Main Coil (MC).

Next, let's look at the **Control Section** of this circuit. This is the part of the circuit that tells the Transistor (T) when to turn ON and when to turn OFF.

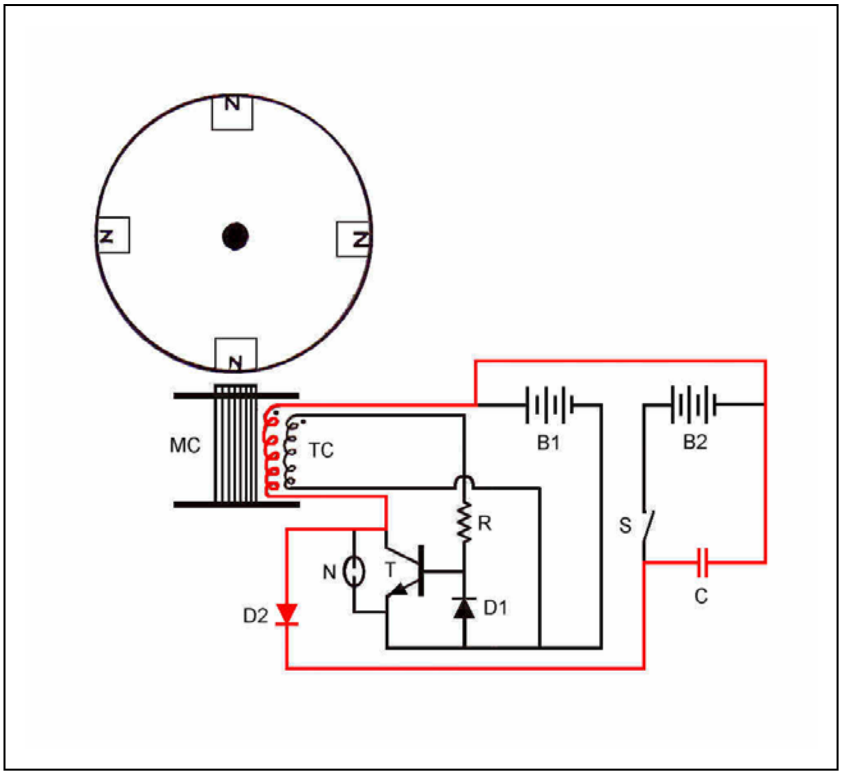


The power to operate this part of the circuit comes from changes in the magnetic field in the coil core and its ability to generate electricity in the Trigger Coil (TC). The control section of this circuit consists of both the Resistor (R) and the Diode (D1). The output of this section of the circuit is the proper set of conditions to activate the Base of Transistor (T) so that it turns ON and OFF at the right time to run the Power Section properly.

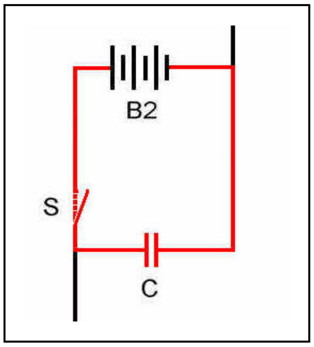


The rising and falling of the magnetic field in the coil core produces an AC wave in the Trigger Coil (TC). When the current flow (CF) follows the path shown in the first diagram, the Transistor is OFF. When the current (CF) follows the path shown in the second diagram, the Transistor is ON.

The **Output Section** of the circuit is next. After the Transistor (T) turns OFF, the current supplied by Battery (B1) stops supporting the magnetic field in the Main Coil (MC). When this happens, the magnetic field must collapse. In doing so, it induces a burst of electrical energy in Main Coil (MC) that can be collected. Capturing this energy is one of the main reasons for learning about this project.



The Output Section of the circuit is shown in **RED** in this diagram. So, the collapsing of the magnetic field in the Main Coil (MC) is the power supply for the Output Section. With the Transistor (T) turned OFF, the only pathway left open is through Diode (D2) and around to charge up Capacitor (C).



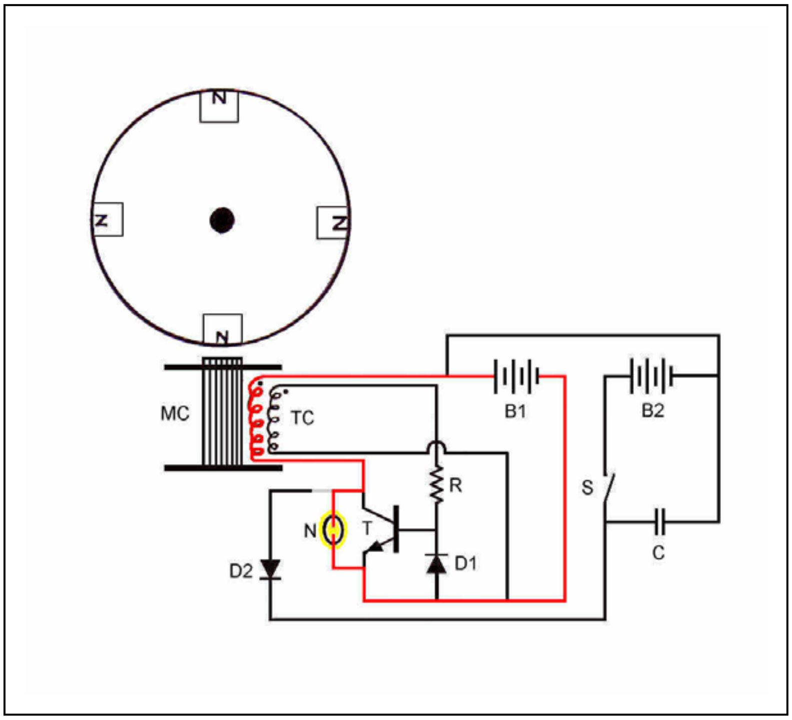
Diode (D2) is the control component in this section of the circuit. It allows the discharge of the energy in Main Coil (MC) to divert around the Transistor (T) and also facilitates the charge in Capacitor (C) to build up without discharging. The charging of Capacitor (C) is the desired, end result of this section of the circuit.

Of course, the final Output is for the Capacitor (C) to discharge into Battery (B2), as shown when Switch (S) closes temporarily. In this section, Capacitor (C) is the power source, Switch (S) is the control device, and the charging of Battery (B2) is the end result, the final Output, and the last operation of the circuit.

In Summary, the circuit works like this. A quantity of electricity is taken from Battery (B1) and used to produce a magnetic field in Main Coil (MC). That magnetic field is used to create a mechanical action upon the magnet on the wheel. After this operation is finished, the energy in the magnetic field is discharged. The electricity produced by the discharge of the magnetic field is then captured in the Capacitor (C). As multiple discharges of the Main Coil (MC) accumulate, the voltage in Capacitor (C) rises high enough so that the excess electricity can be transferred to Battery (B2).

This sequence of events produces what Nikola Tesla referred to as a "shuttle circuit" where electricity is transferred from location to location, but never allowed to "ground out", dissipate, or be lost entirely. This method represents the true meaning of "Energy Conservation."

There is one other possible operation of the circuit, and that is the **Safety By-Pass** through the Neon Light. When the magnetic field collapse happens in Main Coil (MC), the energy MUST discharge SOMEWHERE! If, for any reason, it is prevented from discharging through Diode (D2) as shown on the previous page, a secondary path must be available to dissipate this energy, or Transistor (T) will be damaged.



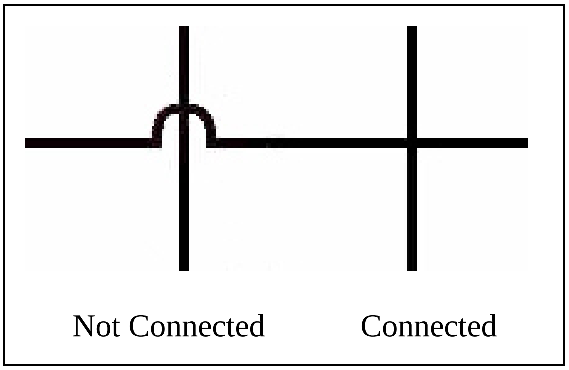
This Safety By-Pass circuit is outlined in RED here. When the Main Coil (MC) discharges its energy and the pathway to Diode (D2) is not available, Neon Light (N) will light up, forming a new, temporary connection back to the Main Coil

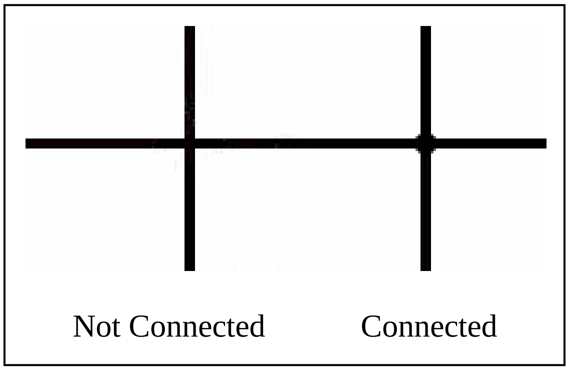
(MC) through Battery (B1). While this is not the preferred way to collect this energy, it does allow the energy to be safely dissipated without damaging Transistor (T) by subjecting it to a very high voltage spike.

Hopefully, by now, you have a pretty good idea about how this circuit works, and how to read a schematic diagram. You'll need to know all of this stuff as you move into the next chapter, where you will find complete instructions on how to build your very own model of the Bedini SG.

But before we do that, there is one more, minor detail about reading schematic diagrams that I would like to bring to your attention. That issue relates to how best to symbolically represent when "wires cross each other and connect" and "when wires cross each other and DO NOT connect." Unfortunately, there are TWO methods to express these different situations, and it’s a little confusing if I don't show you both methods.

The first method is the method I have been using in the schematic diagrams in this book. As shown in this first drawing, the image on the left that looks like the horizontal line is looping over the vertical line, represents where the two wires cross each other in the diagram, but ARE NOT electrically connected. The image on the right that looks like the lines form a cross represent where the two wires come together in the diagram and ARE electrically connected.





The second method is used in some of the patents in the back of the book and looks like this. The image on the left, where the lines cross, represents where two wires cross over each other in the diagram, but ARE NOT electrically connected. The image on the right, where the lines cross with a round DOT over-laying the cross, represents where two wires come together in the diagram and ARE electrically connected.

So, when reading a schematic diagram, it is helpful to quickly determine which method is being used, or you may misinterpret the circuit.

Which Way does Electricity Flow?

People have been doing practical things with electricity since Ben Franklin invented the "Lightning Rod" back in 1749. His concept was that the earth (ground) was Negative and the stormy sky had a Positive quantity of electricity. It appeared that when lightning struck, it moved from the sky towards the ground. So, the convention developed that electricity flowed like heat, from the location that had an excess (Positive) to the location that had less (Negative).

When the Electron was discovered by Joseph J. Thomson in 1897, it was found to hold a "negative charge." This lead to the "Electron Current Theory" of electricity which postulates that electricity is the flow of electrons. This explanation assumes that electricity flows from Negative to Positive. For the last 115 years, people have believed both explanations.

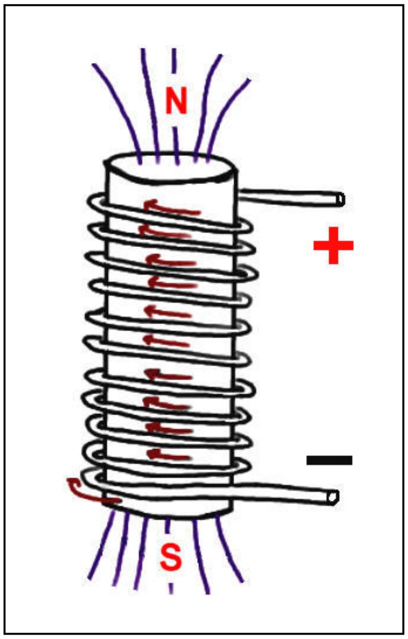
At this point, Electron Current Theory is taught mostly in North America, and Conventional Theory is taught in Europe and Asia. Regardless of which theory may be right or wrong, all of the circuit explanations in this book use the **Electron Current** model and assume that the electric currents are flowing from **Negative to Positive** in the circuit.

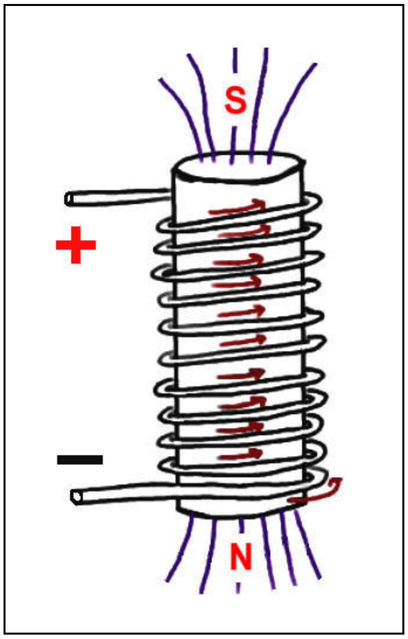
[Author's Note: If you were taught Conventional Theory, please realize that all of the explanations in this book are not "wrong."]

Which Way does Magnetism Flow?

Magnetic fields also flow between the poles of the magnet. Some people believe that they flow from the North Pole to the South Pole. Some people believe they flow from the South Pole to the North Pole. And still others believe that energy flows from both poles and re-enters the magnet in the center, at the so-called "neutral line." Maybe in the next 100 years, our understanding of magnetism will sort all of this out.

One thing that we do know about magnetic fields is how to make either a North Pole or a South Pole appear where we want in an electric coil.





In the drawings to the right, the two methods of winding are shown. Viewed from the top of the coil, the first example shows the current entering from the bottom, winding around the magnetic core in a clockwise direction, and exiting at the top. This current flow and clockwise winding produces a North Pole at the top and a South Pole at the bottom.

The second example shows the opposite arrangement. Viewed from the top, the second example shows the current entering from the bottom, winding around the magnetic core in a counter-clockwise direction, and exiting at the top. This current flow and counter-clockwise winding produces a South Pole at the top and a North Pole at the bottom.

Reversing the direction of the current flow in either case will also reverse the polarity of the magnetic field.

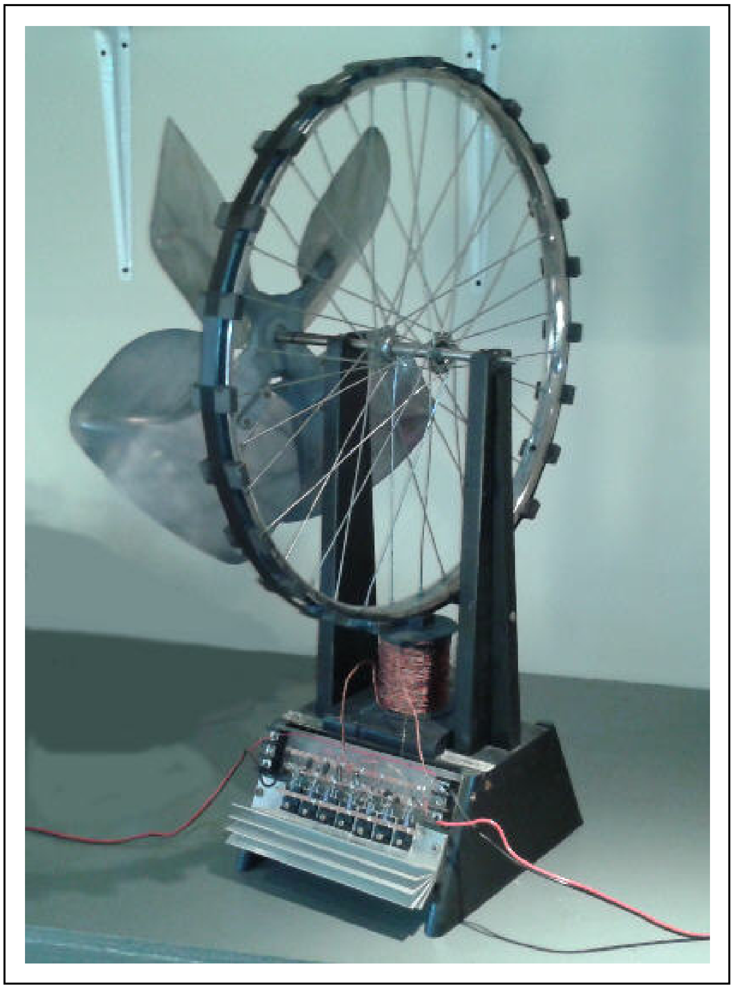
OK. You now know more about this project than any of us ever did before we built our first model. It's time for you to build your own Bedini SG!

Chapter Five

Building the Bicycle Wheel Energizer

The goal of this project is for YOU to build a machine which has a positive, net energy gain! We refer to this as a "Co-efficient of Performance greater than One" or simply COP>1 for short. While this is POSSIBLE, it is not magical or automatic. In order to actually accomplish this, your model still needs to be built both correctly and accurately. The purpose of this project is for you to "see for yourself" that Nature allows this energy gain, and that the way Physics is taught concerning the "Conservation of Energy" is not correct. If you follow these instructions, AND you use your own "common sense", you will succeed.

As the picture shows, the unit consists of a base and Frame that holds all of the other parts in place, a Wheel with 24 magnets mounted on it that is free to turn with low friction, a Coil with 8 separate strands of wire on it, and a Circuit that consists of 7 transistors, 7 resistors, 14 diodes, 7 neon bulbs, and 2 batteries.



On the following pages, each of these sections of the project will be discussed in detail. Follow the directions correctly, and Good Luck!

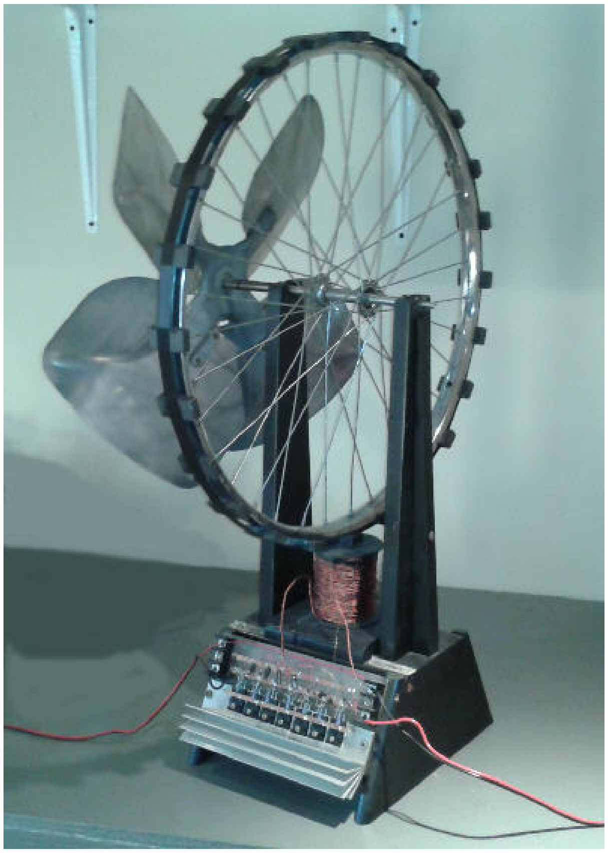
So, here is the basic list of materials you will need:

1. The entire **frame** can be made from one piece of wood 12" x 48" x .75." When you purchase this, make sure that the board is straight and flat. It should be either REAL WOOD or a thick, quality plywood. The unit shown is also painted black. It you are planning to finish the wood after you build the frame, decide how you are going to do that. You will also need some wood glue and some screws to fasten the pieces together after you have cut them to the right shape.
2. The **wheel** is a 20" bicycle wheel used for the front of the bike. Any wheel of this type may be used, metal or plastic, standard or metric, spoked or solid. John's original unit used a steel rim with standard bicycle wheel spokes. You may simply mount the bicycle wheel to the frame using the internal bearings in the wheel. If you want to drive an external load, like a fan blade or a timing wheel, you will also need a piece of straight, machine grade shaft and a set of bearings to mount in the frame. The shaft and bearings should have the same diameter, such as .375 inches or 1 cm.
3. The **coil** is made from a plastic spool that is 3.25 inches high, 3.5 inches in diameter, with a central cylinder of .75 inches in diameter. This spool is wound with 8 wires that are twisted together. 7 of these wires are #20 magnet wire 130 feet long, and the 8th wire is #23 magnet wire 130 feet long.
4. The **circuit** consists of 7 MJL21194-G transistors; 7 470 Ohm, 1 Watt resistors; 14 1N4007 Diodes; and 7 NE-2 neon lights. All of these components can be purchased from Mouser Electronics.

You will also need various tools, a soldering iron, some electrical solder and flux, bearings, a piece of machine grade shaft about 1 foot long, 24 (1" x 2" x .5") permanent magnets made from Ceramic 8 material, an aluminum plate to act as a heat sink for the transistors, and various types of wire.

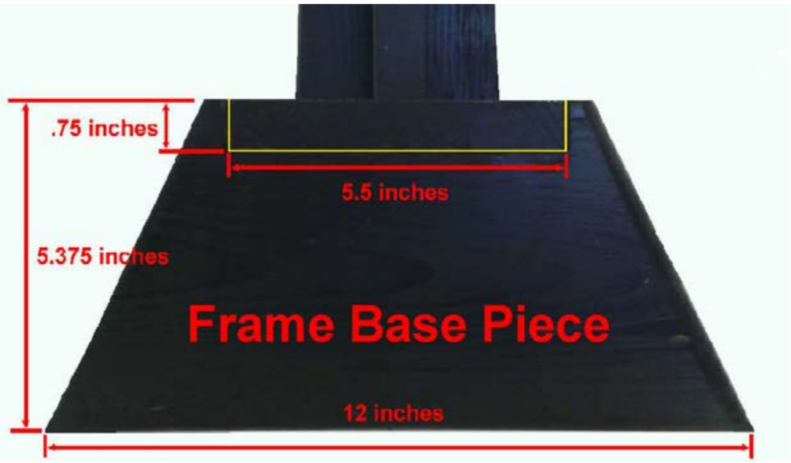
The following directions allow you to make a replica of John's Original Bicycle Wheel model with the simplified output circuit that puts the discharges of the coil directly into the second battery. (Like on page 29.)

The Frame is any physical structure that holds all of the parts in place while providing a stable base so the machine may operate safely without tipping over. The following directions give the dimensions of the parts of the frame that John used for his model so that it can be duplicated exactly. That said, any design of a frame that produces a non-magnetic structure, a wide and stable base, as well as a firm holder for the wheel, the coil, and the circuit will work just fine.

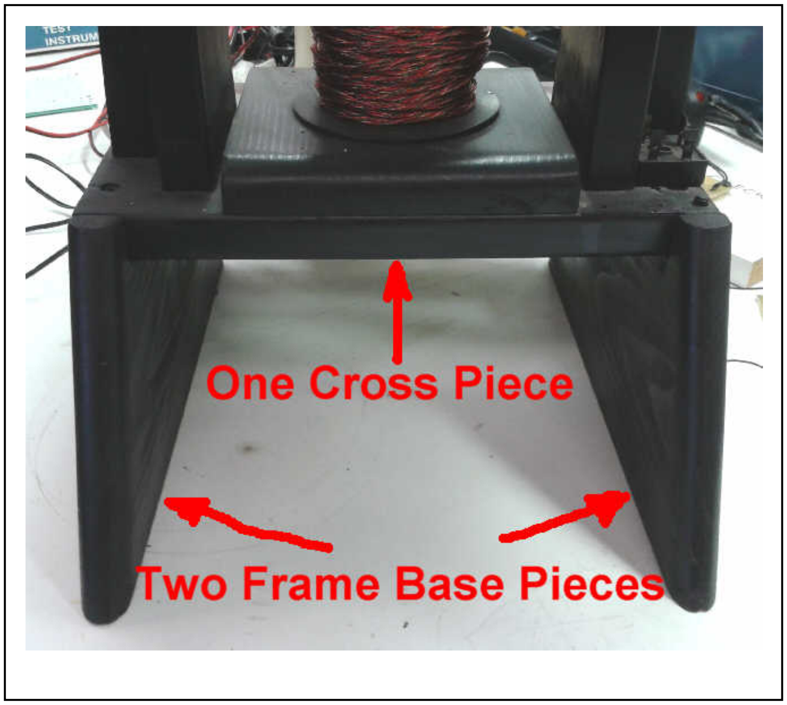


John's model has a frame made of wood. It consists of 8 pieces connected together. They are: 2 pieces that form the base, a single cross piece with a second piece on it to raise the level of the coil, and then 2 uprights to hold the wheel in place with 2 smaller uprights to stabilize them. In total, 8 pieces of wood ¾ of an inch wide, cut to the right shapes and joined together with glue and screws.

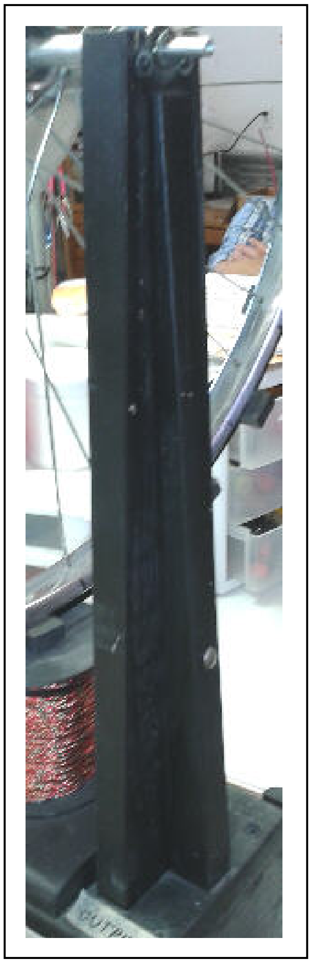
The Frame Base Piece is 12 inches across the bottom and about 7 inches across the top. Both side edges are cut on a slant and sanded to produce a rounded appearance. The top has a section cut out of it to hold the Cross Piece, shown here as the area marked out in Yellow.



Here is another photo of the base, shown from the rear. It shows how the 2 Frame Base Pieces are held together by the Cross Piece, as well as how the extra piece is used to raise the level of the Coil. It also shows how the Upright Supports are mounted on the Cross Piece.



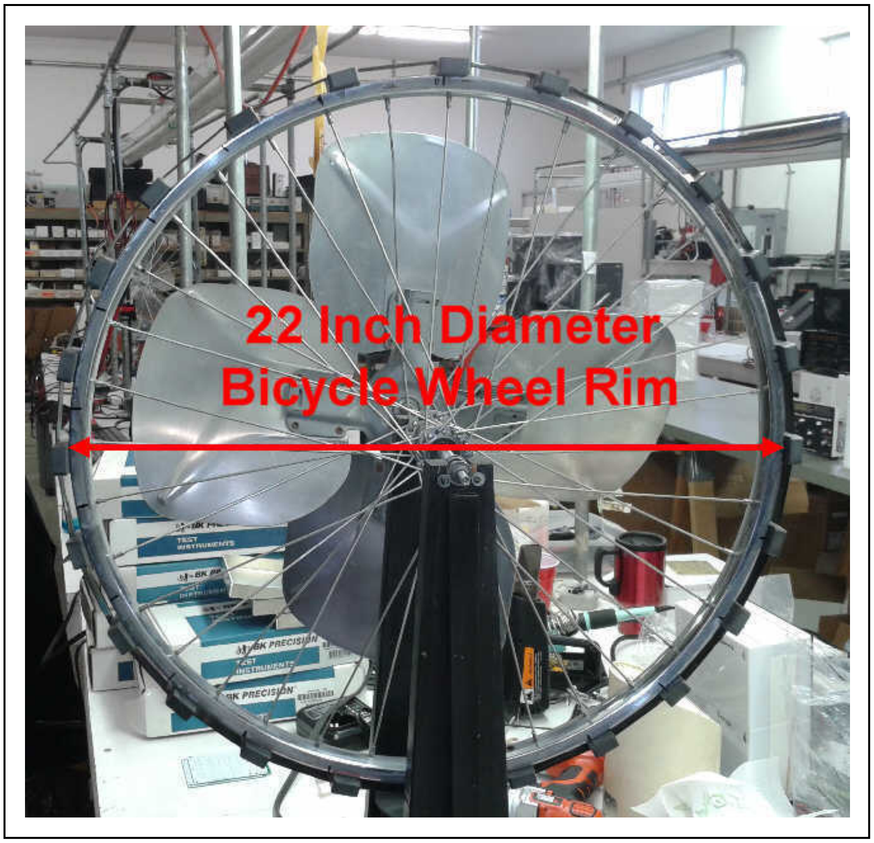
The Cross Piece is a simple rectangle shape 5½ inches wide and 10 inches long. It is glued and screwed into the cut-out sections of the upper edges of the 2 Frame Base Pieces to form the solid base upon which everything else is mounted.



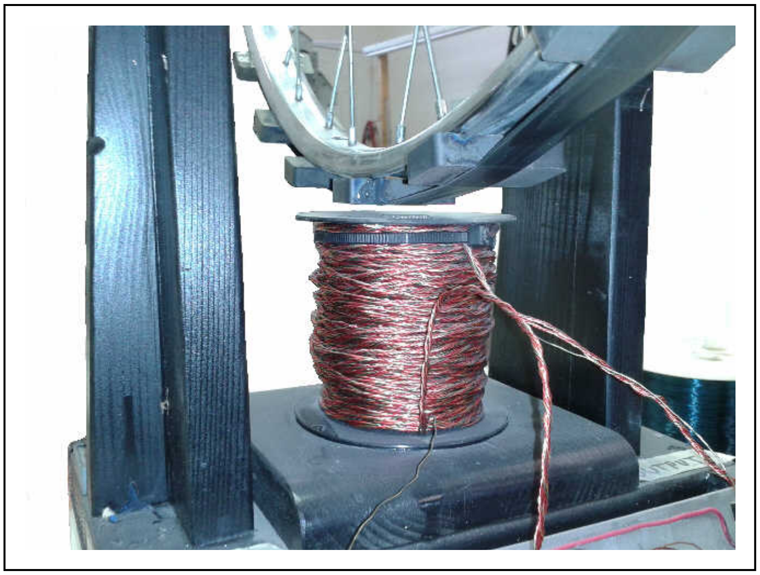
The Upright Supports are made from the same wood material that is ¾ of an inch thick. There are two of these Upright Supports, one on either side of the coil. The main piece is 15¾ inches high, 3¾ inches wide at the bottom and 1¾ inches wide at the top. There is also a cut-out at the top to hold the bearings that support the shaft. The secondary Uprights are 15 inches high, 1 inch wide at the bottom and ⅛ inch wide at the top. These secondary Uprights are glued and screwed onto the main Upright Supports to add stability and lessen "side-to-side" movements.

These Upright Supports are connected to the Cross Piece with glue and are screwed up from the bottom. Any changes to this design that accomplish the same objectives are acceptable and allowed.

The Wheel is made from a bicycle wheel rim. While any rim from the front wheel of a bicycle will do, the one John used is from a "26 inch" bicycle tire. The exact dimension of the wheel rim is 22 inches, measuring from the outside of the rim on one side to the outside of the rim on the other side.

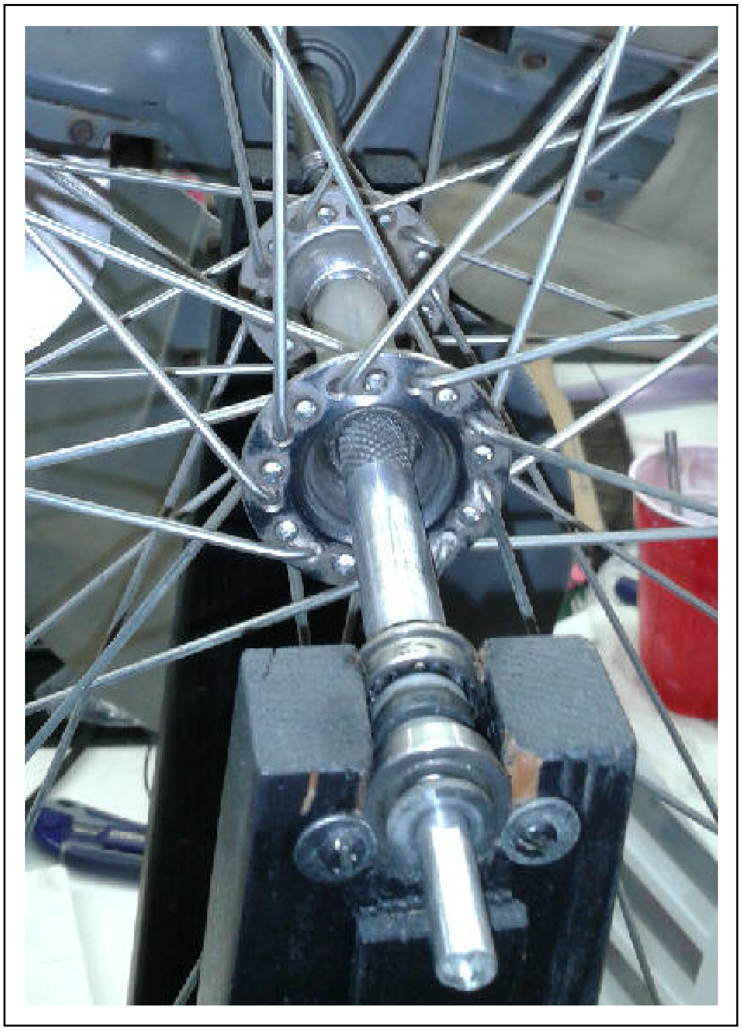


The precise dimension of the wheel is NOT critical. The wheel can be spoked or solid, steel, aluminum or plastic, English dimensions or Metric. What is important is that the wheel is perfectly round, well balanced, and rotating in a good set of bearings with low friction.



24 permanent magnets, measuring 1 x 2 x .5 inches, made from Ceramic #8 material, are mounted around the rim with a uniform 3 inch spacing between them. All magnets should have the NORTH POLE facing outward.

If you use a standard steel rim, the magnets will stick to the metal. Even so, once you have determined the exact placement positions for the magnets, they should be GLUED to the rim. After the glue dries, a layer of STRAPPING TAPE should be wound around the entire wheel, to prevent any magnet from flying off during operation.

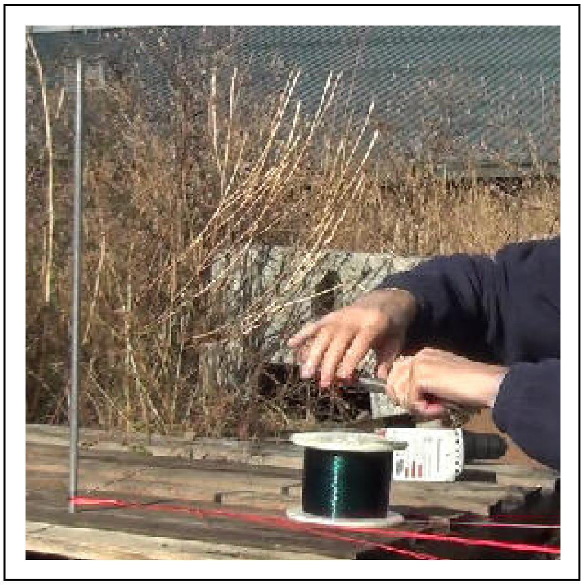


The wheel should be held by the Upright Support Pieces so that the clearance between the magnets and the top of the Coil is about ⅛ of an inch, as shown in the photo above.

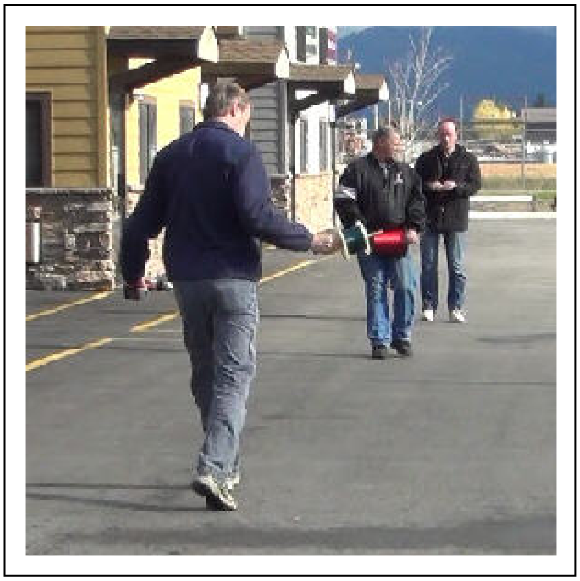
This spacing can be accomplished either by adding spacers below the coil or by having an adjustment at the top of the Upright Support Pieces so that the shaft holding the wheel can be raised or lowered as needed. This picture shows a close-up of the hub of John's model. You can see that the internal bearings in the wheel have been removed and a piece of shaft material has been inserted. This shaft turns with the wheel and is supported by the external bearings shown in the foreground. This allows John's model to rotate a fan blade during operation.

The wheel can also be operated using the bearings that come with it inside the hub. In that case, the threaded connectors that come out of the wheel hub simply need to be supported by the Upright Support Pieces and held in place by nuts and washers.

The Coil is the next major component, and possibly the most difficult to make. It consists of a plastic spool with 8 lengths of wire wrapped around it. Although that sounds simple enough, there is a specific method to this that must be followed in order to achieve the best results.



The Coil consists of 8 strands of wire that are each 130 feet long. John's original Bicycle Wheel Energizer used 7 strands of #23 wire and 1 strand of #26 wire. This is acceptable for this project. However, it has been determined that 7 strands of #20 wire and 1 strand of #23 wire actually works better, and is recommended.



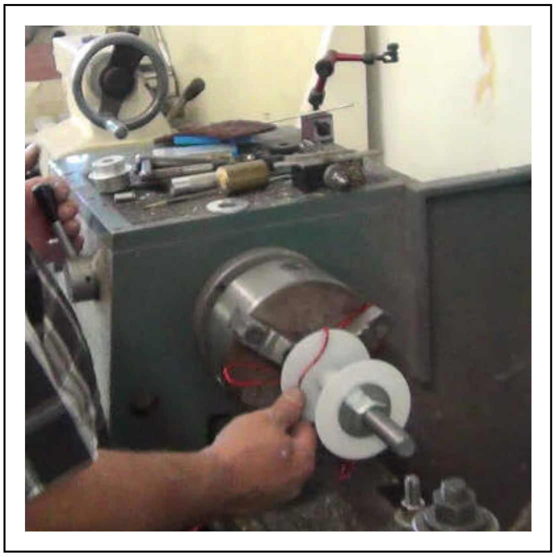
The first thing to do is purchase the wire you are going to use. You will need at least 910 feet of the larger wire, cut into 7 lengths of 130 feet each, and 130 feet of the smaller wire. [Wire suppliers are listed in the Appendix of this book.]

Next, establish an anchoring post to attach the wires to, as shown in the top photo, so they can be measured out. Measure out all 8 strands of wire by unreeling them from their spools, as shown in the second photo. When all 8 strands are measured out, tie them off to an "eye-bolt" and tighten the eyebolt into the chuck of a portable drill, as shown in the last photo here. Next, from the eyebolt, stretch all of the wires back toward the anchor post and re-attach them to the anchor post so that each wire is exactly the same length. You'll see why this is important in the next picture.

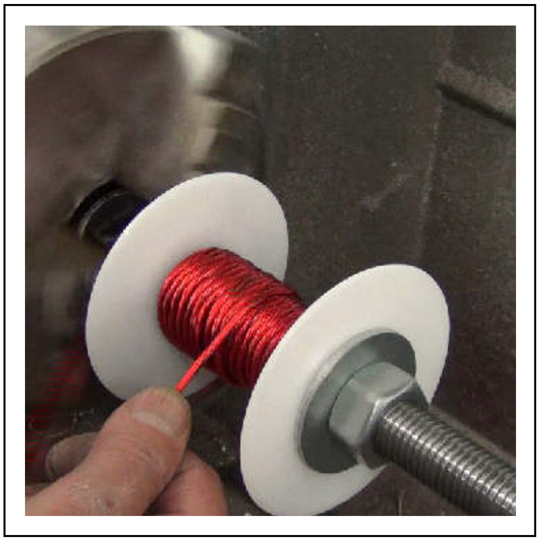
Next, use the drill in "FWD mode" to TWIST the wires together along their length to make an 8 wire cable. You can see in the photo to the right that the trigger winding is **BLUE** and the cable has been twisted until there is about "one twist per inch" along the length. You should also be able to see by my finger that one of the wires is sticking out a little bit from the twisted bundle. This happened because one of the wires was a little bit longer than the rest after the stretching operation. While a few of these twist imperfections are OK, doing the previous step carefully is important.

After the cable is twisted, it should be hand wound onto a temporary spool, as shown in the photo to the right.

The next operation is to wind the coil. In the photo to the right, you can see John has taken the white plastic spool and put a large bolt through it, cinched it down with a nut and a washer, and mounted it in the chuck of a power lathe. The start of the cable is looped over the edge nearest the lathe and the lathe is going to rotate "clockwise" in

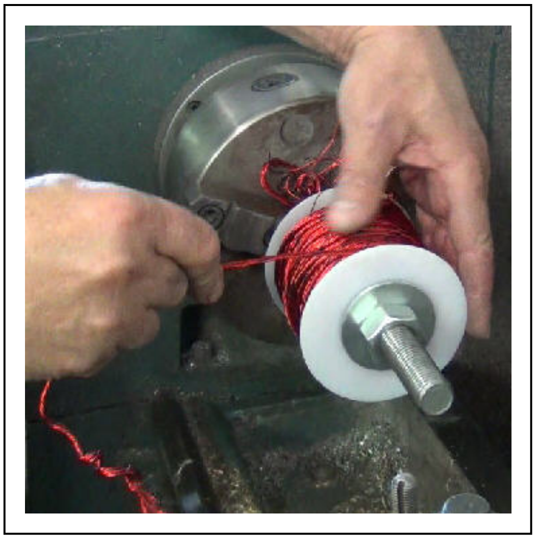


this photo, or away from John. This will be the "bottom" of the coil. Here you can see the winding process is moving forward. The cable should be laid down in tight, neat rows and smooth layers, in the best way possible.



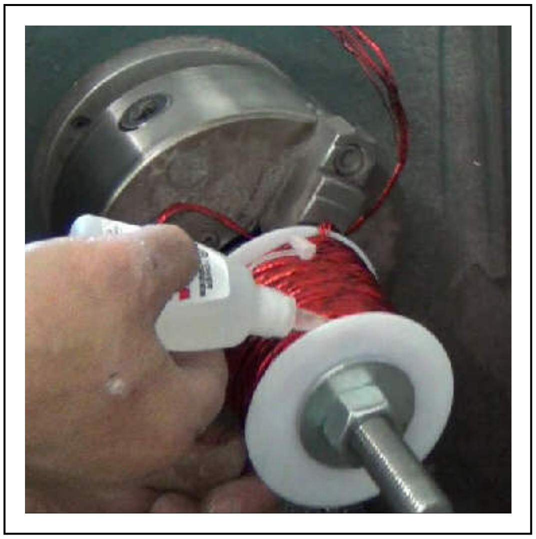
It is also permissible to wind this coil by hand, but it is much more difficult to keep all of the rows tight and the layers smooth, and finishing it out without at least a manual winding jig and an assistant.

In the next photo, the coil has been wound to the end of the cable. John has purposefully ended the winding process with the cable at the outer end of the spool. This will be the "top" of the coil.



The next process is to secure the cable in the spool so it won't unravel when you let go of it. Up until this time, a constant tension has been maintained on the cable and the spool to wind the cable tightly.

While still holding the cable, John applies some "super-glue" to the last windings, where the cable will be coming out of the coil.

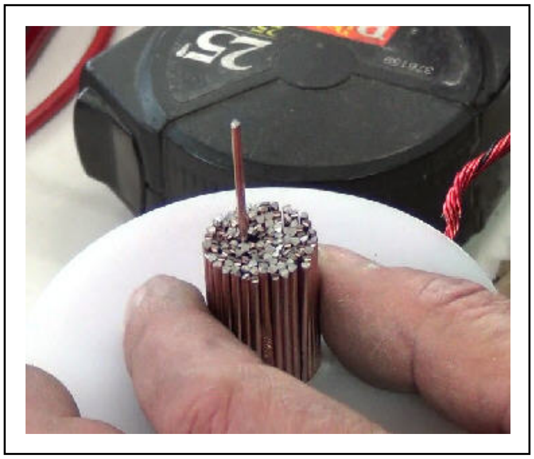


Make sure that the "super-glue" sets properly and is holding the winding in place before letting go of the cable. This operation creates the primary "strain

relief" of the cable on the spool and keeps it from coming apart.
After the gluing operation is done, the secured wire is bent back around the spool, and a few layers of black tape are applied to further secure the final windings. Again, this is the "top" of the coil. With the layer of black tape applied, the top of the coil is always easy to identify, from now on.

At this point, the coil is removed from the lathe and the bolt is removed from the center of the spool.

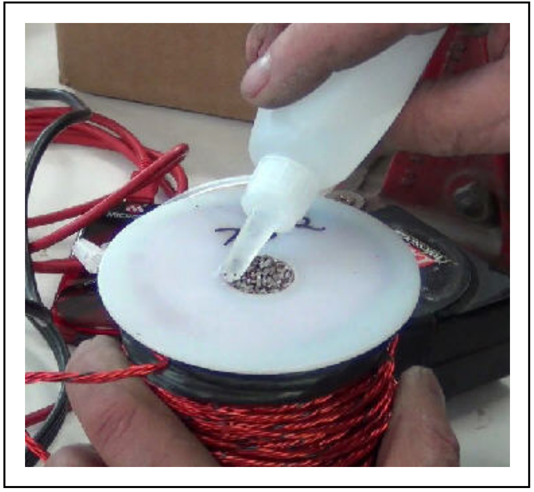
The next operation involves filling the core of the spool with the iron "welding rod" sections, as shown in the photo to the right. These are 1/16th inch diameter R45 mild steel welding rods, cut to 4½ inch lengths. You need about 150 of them.



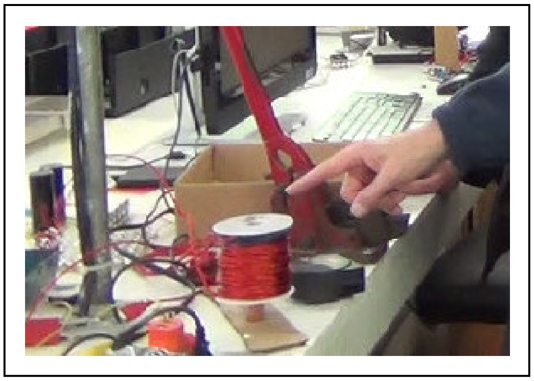
The coil is placed "top down" on a flat work surface and the welding rod sections are inserted into the central core hole until it seems like no more will fit. Then, one at a time, one more rod is carefully hammered in until no more rods can be inserted, even by force.

It's important that all of the rods are cut to the same length so that they all come through to an equal height on the "other end" of the coil, which is going to be the "top" of the coil that faces the magnets on the wheel.

Every single step needs to be done carefully to produce the best results. After all of the welding rods have been inserted, the coil can be turned over so the top is exposed again. Make sure to place the coil, which is now standing up on the rods still sticking out the bottom, on a piece of disposable cardboard.

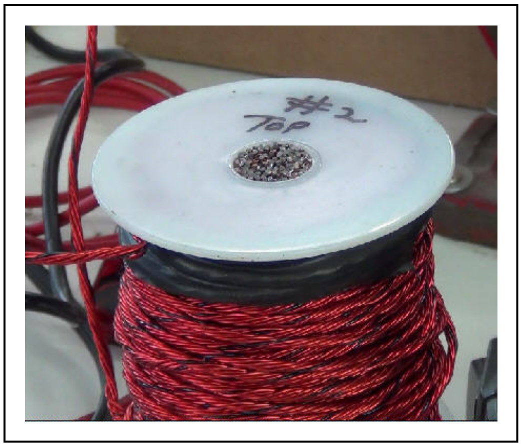


Next, apply "super-glue" around the edges of the rods and all across the surface of the rods, waiting a few minutes and then doing it again. You will see that some of the glue seeps all of the way down through the stack onto the cardboard. Make sure all of the rods are securely glued in place.

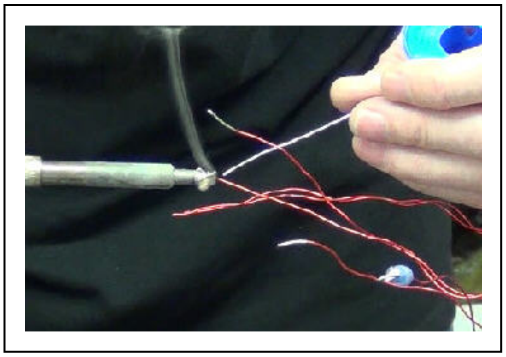


This process is really important, because you do not want one of these rods to rise up and impact a magnet on the wheel when it is spinning fast during operation.

So, here is a close-up photo of the "top" of the coil. This makes a coil that is wound in the "counter-clockwise" direction. When you get this far, you should be really proud of yourself! You have finished "making" the coil!



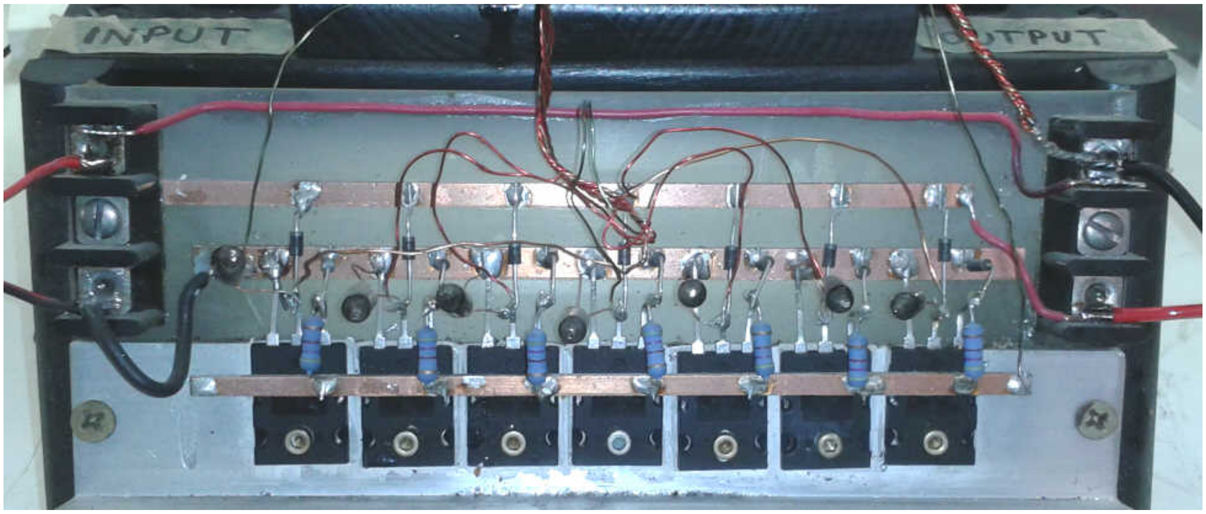
The final operation is to prepare the tips of the wires to be electrically connected to the rest of the circuit. This photo shows the ends of the wires being coated with a layer of solder. This process, however,

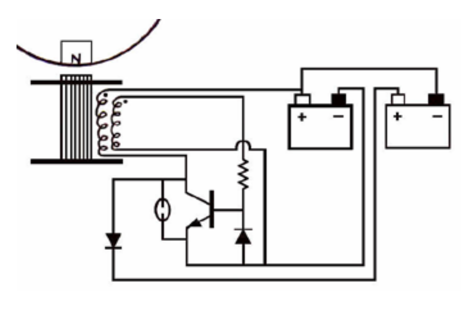


should not be done until the wires are cut to proper length during final assembly.

The Circuit consists of the electronic components wired together to control what is happening at the coil. All of the schematic diagrams you have seen so far show a single Main Coil and a single Trigger Coil. Obviously, we just wound a coil with 8 wires on it, so something is different. What is different is that the Bicycle Wheel Energizer uses a coil that has 7 Main Coil windings on it, along with a single Trigger Coil winding.

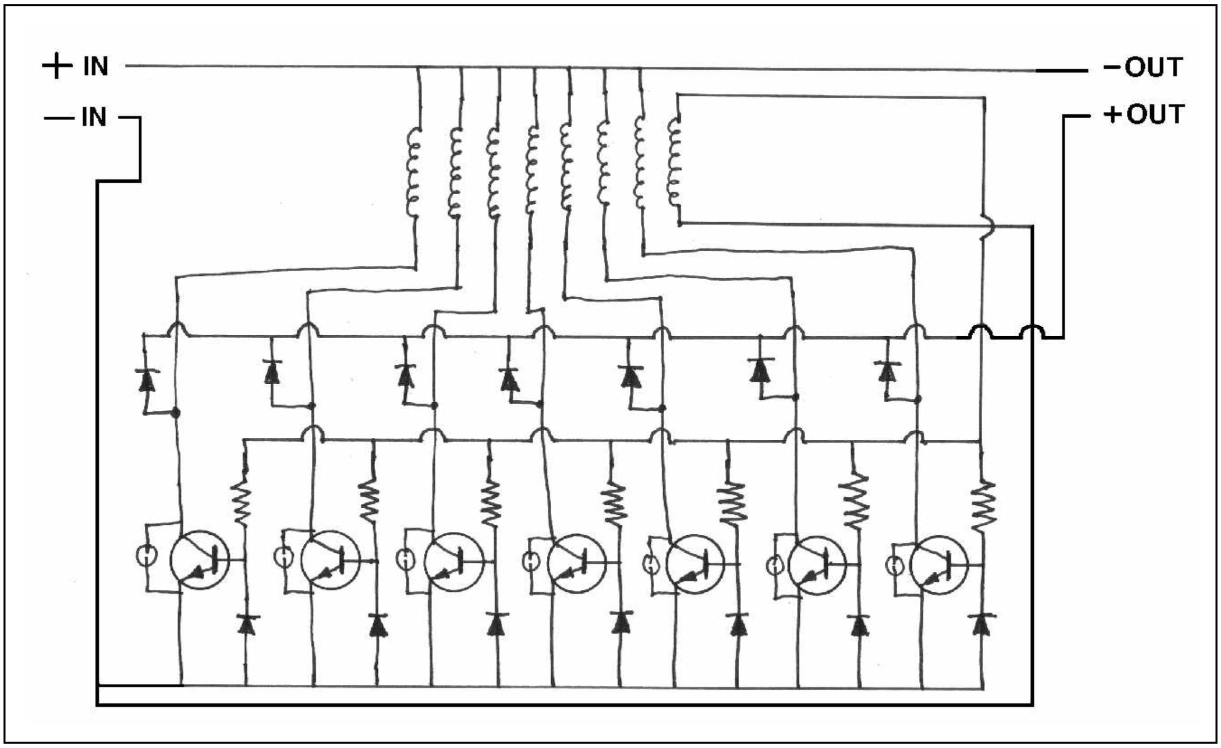
Here is a close-up photo of John's model:





What you are looking at in the photo above is 7 circuits like the diagram to the right, where for each of the Main Coil wires there is a transistor, a neon bulb, a resistor, and two diodes. The wires going to the Run Battery are on the terminal block on the left side, labeled INPUT. The RED wire goes to the battery Positive and the **BLACK** wire goes to the battery Negative. The wires going to the Charge Battery are on the terminal block on the right side, labeled OUTPUT. Again, the RED wire goes to the battery Positive and the **BLACK** wire goes to the battery Negative. Notice that the RED input wire connects directly to the **BLACK** output wire AND all 7 of the wires from the top of the Main Coil windings over at the OUTPUT terminal

block. Then, the wires from the bottom of the coils are separated and each one goes to a transistor collector.
So, here is the complete schematic, as it is shown in the photo above:



There are dozens of ways to lay this out, but the ones that work the best keep all of the components close to each other and use the shortest possible paths to connect the parts.

The transistors are mounted on a sheet of aluminum with a thermal insulator between its back and the aluminum. Heat Sink Grease should be applied to both sides of the insulator. This allows the transistors to keep cool during operation and remain electrically insulated from each other.

So, here is the Parts List for making the circuit. All these parts are available from Mouser Electronics and Radio Shack in the USA, or on-line.

Transistor: MJL21194-G	Mouser Part # = 863-MJL21194G
Thermal Insulators	Mouser Part # = 739-A15038003
Heat Sink Grease	Radio Shack Part # = 276-1372
Diodes: 1N4007	Mouser Part # = 512-1N4007

Resistor: 470 Ohm, 1 Watt	Mouser Part # = 294-470-RC
Neon Lamp	Mouser Part # = 606C2A

You should buy extras of all of the parts, in case you run into trouble building the circuit. So, buy at least 10 of the transistors and thermal Insulators, at least 20 of the diodes, and 10 each of the resistors and neon bulbs. You can purchase the parts right on the Mouser website. One 6 gram tube of the Heat Sink Grease from Radio Shack should be enough.

Make sure that all of your solder joints are produced by a good, hot flow of solder to each component. If the solder doesn't flow to the pieces easily, you may need to apply more solder flux to the joint before re-heating. When you are done, retrace the circuit and compare it to the schematic diagram again to make sure everything is connected correctly.

Final Assembly of the unit is the last step. By now, you should have the frame, the wheel with the magnets on it, the coil and the circuit all built and ready. The next step is to mount the coil on the frame. You may have noticed that the iron welding rods are sticking down past the bottom the coil. This is to help secure the coil to the frame.

Drill a hole ¾ of an inch in diameter into the middle of the Cross Piece of the frame and directly between the two Upright Supports. When you mount the wheel on the Uprights, you want the bottom magnet to be directly over the top of the coil. So play around with these components in order to make sure that their final, secured location is in direct alignment with each other. When everything is decided, glue the coil to the Cross Piece of the frame (using Silicone Glue) and align it so the wires come out on the side that will become the front.

Next, mount the Circuit you have built to the front of the Frame Base Pieces, so the circuit is easy to work on and close to the wires coming from the coil. Your set-up should look something close to the picture on page 51.

After both the coil and the circuit are mounted to the frame, it is time to wire them together. The wires coming out of the top and bottom of the coil

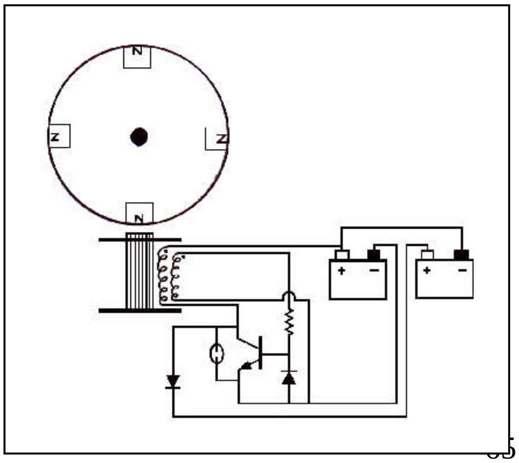
should all be cut to the same length. Make sure that length is sufficient for all of the bottom wires to reach a transistor.
At each end, the Trigger Coil wire (smaller diameter wire) should be separated from the rest of the wires. Make sure that the Trigger Coil wires connect to the circuit in the correct places, according to the schematic.
NOTE: If the Trigger Coil wires are connected to the circuit incorrectly, the Energizer will NOT operate. Everything MUST be wired correctly.

Next, make sure that each of the Main Coil wires coming from the bottom of the coil is connected to one of the Transistor Collectors. Also, solder all 7 wires coming from the top of the coil together, and connect them to the common between the two batteries.

After you have mounted and wired the coil and the circuit together, it's time to mount the Wheel on the Upright Supports. Hopefully, you have already determined the exact mounting location for the Wheel and Bearings, so now is the time to secure them in place. At this point, you are almost done!

The last operation is to connect two sets of wires to the INPUT and OUTPUT terminal blocks so your Bedini SG Energizer can be connected to its batteries. We usually use "alligator clips" on the ends of these wires for easy connecting and disconnecting. We recommend that you color code the alligator clips to be **RED** for the Positive wires and **BLACK** for the Negative wires. We also recommend that you clearly mark which wires are for the INPUT and which wires are for the OUTPUT, as the photo of the circuit on page 62 shows.

So, this is the END of the Beginner's Build Project. You have built the "Self-rotating Energizer." This design takes the discharges of the Main Coil windings and applies them directly to the second battery, like the diagram to the right. Even though we have discussed charging and



discharging of a capacitor as the final step, this requires advanced skills to implement.
This circuit is sometimes called the Bedini SSG Energizer, which refers to the "Simplified School Girl" circuit. Charging and discharging the capacitor mechanically requires the fabrication of a rotating commutator and brush system that can only be built with a small machine shop lathe. Charging and discharging the capacitor using solid-state electronic timers and switches requires more knowledge of electronics. So, this is as far as Beginner's usually get using normal levels of skill with basic tools.

[The Bedini SG, Book 2 will cover the methods for charging and discharging capacitors, as well as the theory of why this further increases the efficiency of the battery charging process. The Bedini SG, Book 3 will cover adding a "low-drag" generator to recover as much of the mechanical energy as possible, to further increase battery charging for the same input. The end result will be a "stand alone" battery charging system and a demonstration of the principles for an independent home power supply.]

The best kind of **batteries** to use for your Energizer are small, lead-acid type batteries because they are inexpensive and charge well with the system. The little "Lawn and Garden" battery type works well.

Operating Instructions:

It's time to "fire up" your new Bedini SSG Energizer for the first time. OK!

1) First, connect the "Charge Battery" to its **Positive** and **Negative** wires using the alligator clips. (Always hook the OUTPUT up first.)
2) Second, connect the "Run Battery" to its **Positive** and **Negative** wires using the alligator clips. When you connect the second wire to the INPUT you should hear a faint "thump" sound from the machine. That is the circuitry recognizing the power available from the run battery with the momentary energizing of the Main Coil and immediate TURN OFF of the transistors. After this, everything should be quiet.

3) Third, give the Wheel a spin and the system should slowly accelerate up to operating speed. Even when fully connected to both batteries, the Energizer will not start rotating on its own. It must be started manually.
4) If everything is working well at this point, it is time to test the "Safety By-pass" system. To do this, just disconnect one of the wires from the Charge Battery on the OUTPUT. Immediately, all 7 of the Neon Lights should come on, and the sound of the machine should get louder. Re-connect the Charge Battery again and the Neon Lights should turn OFF and the machine should run quietly again. **Be careful** when you do this, as a "Shocking Level" of high voltage is available on the alligator clips. Remember, it takes more than 100 volts to light up the Neon Lights!

De-Bugging Errors:

If your system behaved like the description above, you have correctly built your machine. If your machine DID NOT run, some error has occurred somewhere during assembly, either in building the circuit or in wiring it to the coil. Since it is impossible to anticipate all of the possible errors that could happen, please go back through your circuit and see if you can find the problem yourself. If you can't, then go into one of the Internet Forums for SG Builders and describe your problem. The best one is the Beginners Forum at Energy Science Forums. You may have to register to post.
http://www.energyscienceforum.com/bedini-monopole-3-beginners/
Someone there may know exactly what to do in your situation.

*****SAFETY DISCLAIMER*****

Always use safety glasses and have adequate ventilation while soldering, as fumes may be produced that have toxic compounds in them.

You, the builder and user, bear the responsibility for your own safety in building, testing, and using a Bedini SG or Bedini SSG. The risks include, but are not limited to, high voltage output from the coil that could shock you, a high speed spinning wheel that could cause injury if you touch it while running, magnets that may fly off the rotor at high speed if they are not secured properly, or possible explosion risk by sending high voltage impulses directly to a battery. By building this machine, you acknowledge the risks involved in its operation and accept those risks as a result. Under no circumstances will A & P Electronic Media, the authors of this book, or the inventor or assignee of the patents for this machine, be liable for direct, consequential, or incidental damages arising from the use of the Bedini SG or Bedini SSG, and in particular, the model YOU build. You accept these terms by building and using any machine or device discussed in this book.

OK, your system works. Congratulations!!!! Now you can start running it and charging batteries. We also recommend that you get yourself a couple of Digital Multi-Meters so you can monitor your battery voltages. Take notes, and watch what happens as the batteries charge and discharge. To get an idea of what other experimenters have done, visit YouTube and do a search for "bedini motor" or "bedini sg."

You have your "teaching tool" now! It's time to learn the truth about how energy can be transferred and conserved in a circuit at the same time, thereby multiplying the amount of energy available.

Chapter Six

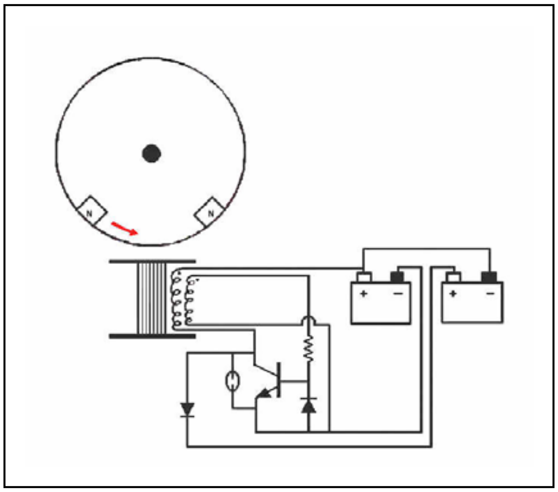
The Two Modes of Running

The idea that there are actually two modes of running this machine will be new to most people. Previously released material has disclosed two circuits for running the device. These two circuits include the "self-triggered" circuit disclosed here, as well as the "forced triggered" circuit, generally referred to as the "Bedini-Cole Switch."

This chapter discloses, for the first time, that there are two, separate and distinct operational modes that can be elicited from the "self-triggered" circuit. Since the main difference between them is in how they produce the mechanical energy, they will be referred to as the "repulsion mode" and the "attraction mode." Both modes work, and John has produced models with COP>1 using both modes. The "attraction mode" does work better, though.

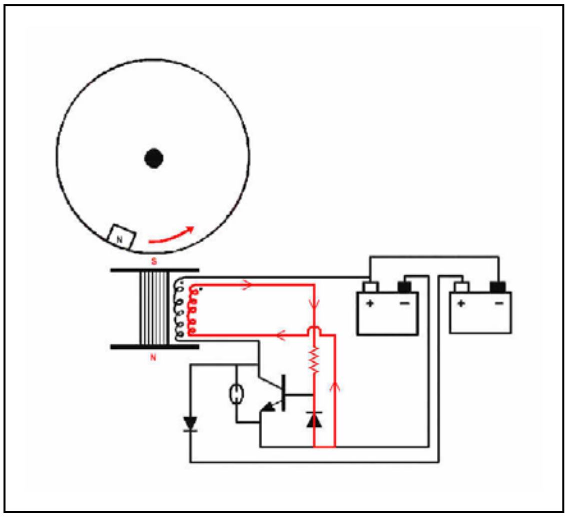
Here's what happened. Most of John's early machines had coils that were wound on his lathe. This method, as shown in the previous chapter, produces a coil with a "counter-clockwise" winding. When John and Peter started making models in 2004, using the "twisted strand" coils, they switched to a hand winding method for winding the coils. This method held the spool still and the wire was looped "over and around" the spool. This produced a "clockwise" winding. Both worked, and so the difference went un-noticed for a while.

When we finally decided to figure out "where the magnet is when the transistor turns on", we developed a "timing light" system to determine when everything was happening. The timing method was somewhat complicated, so we didn't build it into every model. The first two models we put it on had the clockwise, hand wound coils on them. The timing lights clearly showed that the transistor turned ON right after the magnet passed the coil. So, the "repulsion mode" became the standard design and explanation of how the machine worked.

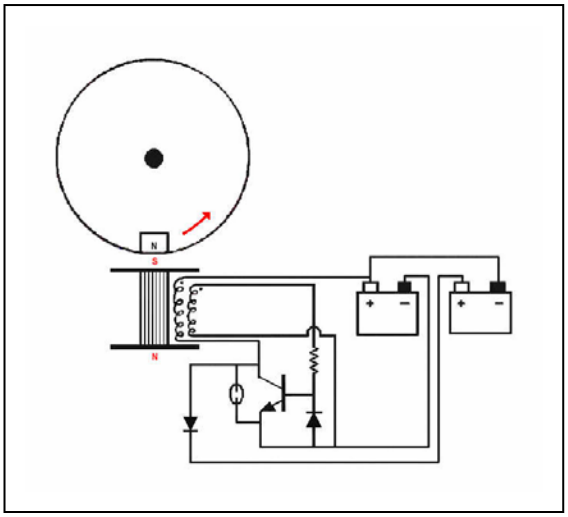


Here is a short re-cap of the Repulsion Mode of operation. Much of this was discussed in Chapter Two.

The cycle starts when one of the magnets is closer to the coil than another and begins to be attracted to the iron in the core. The wheel will turn in either direction, and does NOT affect the operation of the circuit.

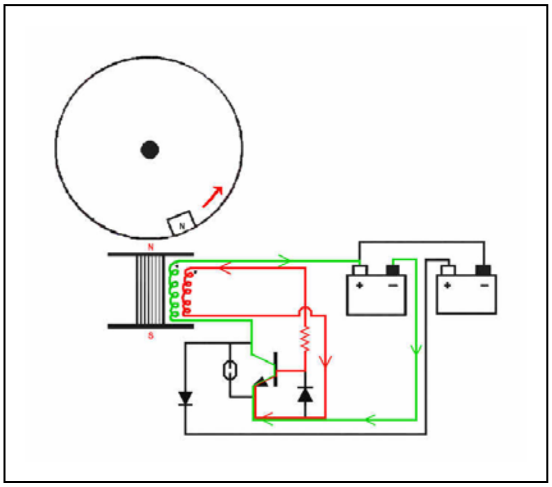


As the magnet approaches the coil, it starts to magnetize the iron core and this "change in magnetic flux" begins to induce a current in the Trigger Winding in the direction of the RED ARROWS. Since this current is in the wrong direction to activate the Transistor, the Transistor stays OFF, and no power is used from the Battery while the magnet approaches the coil.

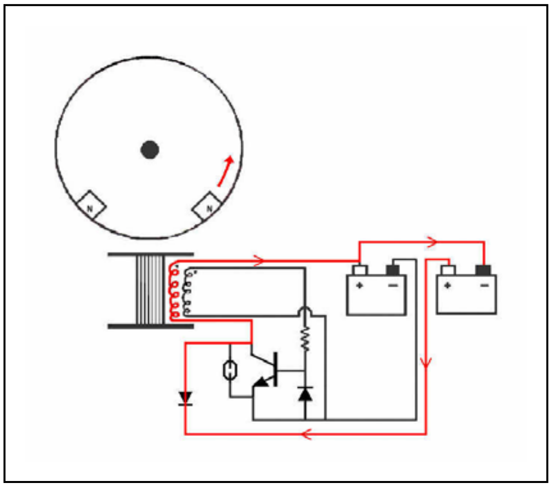


When the magnet is directly over the top of the coil, the permanent magnet has induced its field into the coil core as much as it can. At this point, the "change in magnetic flux" that was inducing the current in the Trigger Winding stops rising, and so the current in the Trigger Coil also stops flowing.

The attraction of the magnet to the coil has produced some momentum on the wheel, so it slips past the top of the coil.

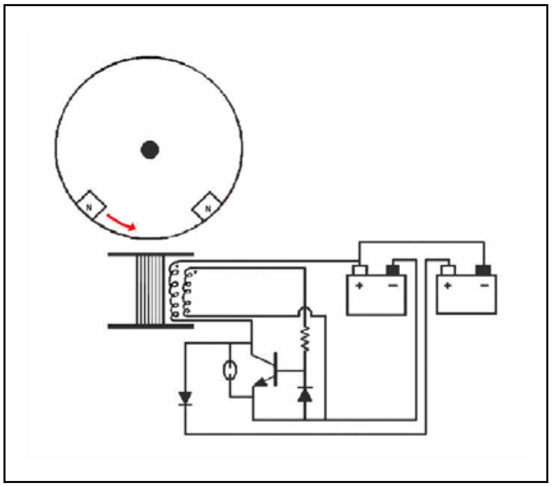


As this happens, the magnetic flux in the coil core starts to drop, and so it induces a current in the Trigger Coil in the opposite direction. This turns ON the Transistor and allows current from the Battery to flow through the Main Coil, as show by the **GREEN ARROWS**. This current from the Battery now reverses the magnetic field in the coil core and produces a "repulsion force" on the magnet on the Wheel, re-enforcing its direction of rotation. As soon as the magnetic field reaches its maximum strength, based on the current delivered from the Battery through the Main Coil, the "change in magnetic flux" in the coil core stops inducing a current in the Trigger coil, and the Transistor shuts OFF. As soon as the Transistor shuts OFF, the magnetic field collapses, and this rapid change of magnetic flux induces a current in the Main Coil that discharges its energy into the Second Battery.

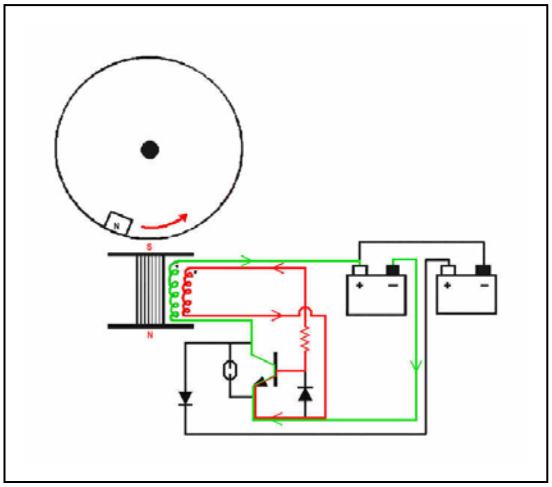


So, this is the basic operation of the "Repulsion Mode" for the machine, and the general method of operation that has been taught for the last 8 years. In that time, the problem has been that most models built by people have not produced the same level of results that John's early models produced. When everything was looked at again carefully, it was finally noticed that the machines that produced the best results all had the "counter-clockwise" coils. We decided to see if any of the experimenters would report the discovery from their own experiments. Only a few experimenter's reported finding this in the forums, but no one else seemed to notice.

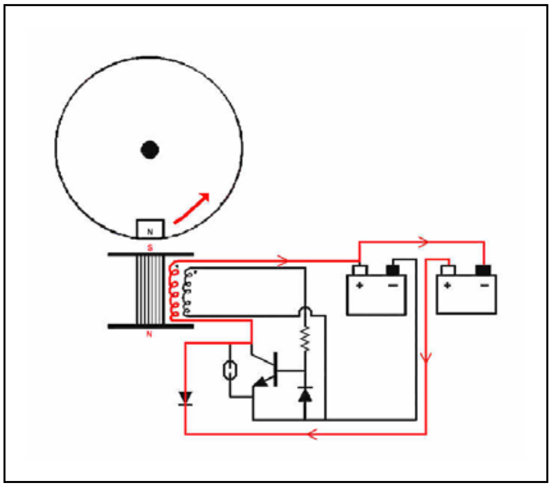
The Attraction Mode of Running



This method of running the machine is identical to the Repulsion Mode except that the Coil is wound in the opposite direction. So, the circuit is the same and all of the magnets on the Wheel have their North Pole facing out.



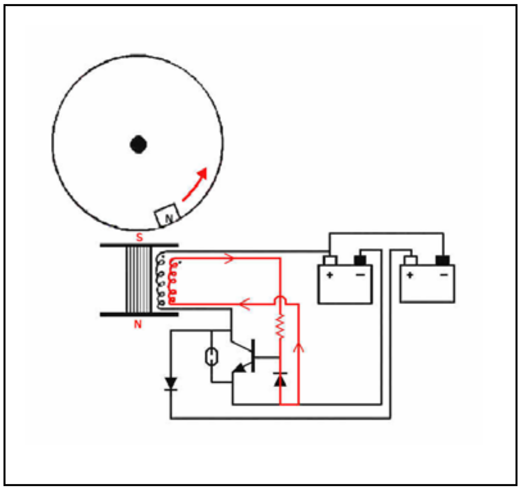
The process starts the same way, when one magnet gets closer to the coil than another. This produces an attraction force on the Wheel. Like before, this approaching magnet induces a magnetic field in the coil core. But now, with the coil wrapped in the opposite direction, this induces a current in the Trigger Coil that turns the Transistor ON immediately.



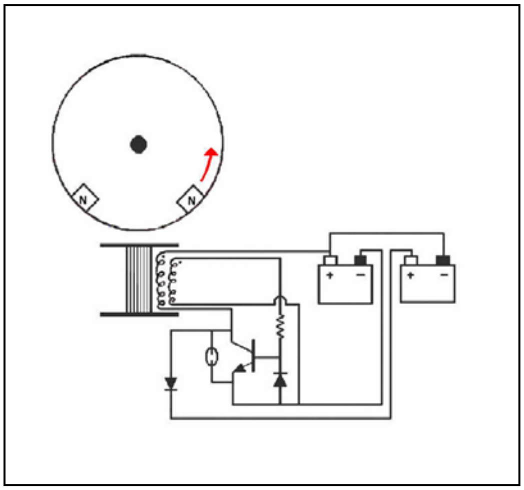
Now, when the current flows from the Battery to the Main Coil, it produces a South Pole at the top, and this re-enforces the induced field and makes the South Pole of the coil even stronger. This attracts the North Pole magnet on the Wheel with a much stronger force, while also re-enforcing the current flow in the Trigger Winding, keeping the Transistor ON.

When the magnet on the wheel arrives at the top of the coil, the magnetic flux stops changing, the Trigger Coil shuts the Transistor OFF, and the Main Coil discharges into the second Battery.

With the collapse of the magnetic field in the Main Coil, the North Pole of the magnet on the wheel is attracted to the coil much less, and so it proceeds out of the field with all of the stored momentum it accumulated during the attraction period.



As the magnet on the Wheel continues to move away, eventually, the combined voltage produced in the Main Coil and the Trigger Coil drops below the level necessary to recover the energy to the second Battery, at which point the last bit of discharge is dissipated in the Trigger Winding.



The magnet then proceeds to the point where the process begins again.

There are a number of reasons why the Attraction Mode works slightly more efficiently than the Repulsion Mode.

These include the following:

1. In the Repulsion Mode, energy from the Battery is used to reverse the magnetic field in the Main Coil. This amount of energy cannot be recovered when the magnetic field collapses. Since the magnetic field never reverses in the Attraction Mode, this loss of energy does not occur.
2. In the Attraction Mode, the mechanical force applied to the Wheel is the highest just before the Transistor turns OFF. In the Repulsion Mode, the mechanical force applied to the Wheel is the lowest just before the Transistor turns OFF. Therefore, the Attraction Mode makes better use of the full current moving through the Main Coil to produce mechanical energy on the Wheel.

Directions, Kits, and Conversions

There was never any intent to obscure the difference between these two running modes. When the first set of Plans and Parts Lists were published in 2004, it was not accompanied by any circuit theory. This Beginner's Handbook is the first attempt to publish both a complete set of plans and a complete explanation of the operations of the circuit in one volume.

The instructions for building your own model, covered in Chapter 5, give you the directions to build a model that runs in the Attraction Mode.

The Kit Models that are being offered for sale, referenced in Chapter 8, all run in the Attraction Mode.

If you currently have a Bedini SG or Bedini SSG model that runs in the Repulsion Mode and you would like to CONVERT it to run in the Attraction Mode, you may do so by making ONE of the following changes to your existing machine.

1. You may replace the existing coil that is wound in the clockwise direction with a coil that is wound in the counter-clockwise direction, and wire the unit the standard way.
2. You may use your existing coil, but reverse all of the connections, so that the wires coming from the top of the coil go to the transistor collectors and the wires from the bottom of the coil go to the positive of the Battery. The two Trigger wires must be reversed, as well.
3. You may leave all of the electronics unchanged, and reverse the magnets on the Wheel so the South Poles face out.

Any ONE of these changes will convert a Repulsion Mode machine into an Attraction Mode machine.

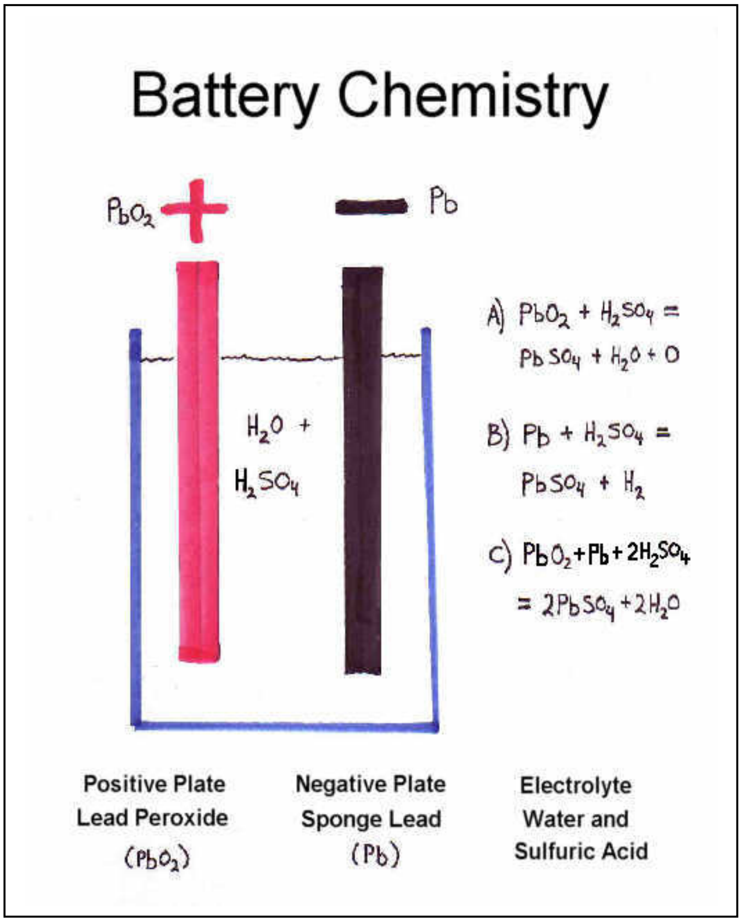
Now you understand both running modes and how to produce them.

Chapter Seven

Battery Chemistry Made Easy

This Beginner's Handbook would not be complete without a little bit of discussion about what goes on inside the battery. After all, this is one of the main places where the energy gain shows up in this project, so knowing a little bit about "battery chemistry" is a good idea.

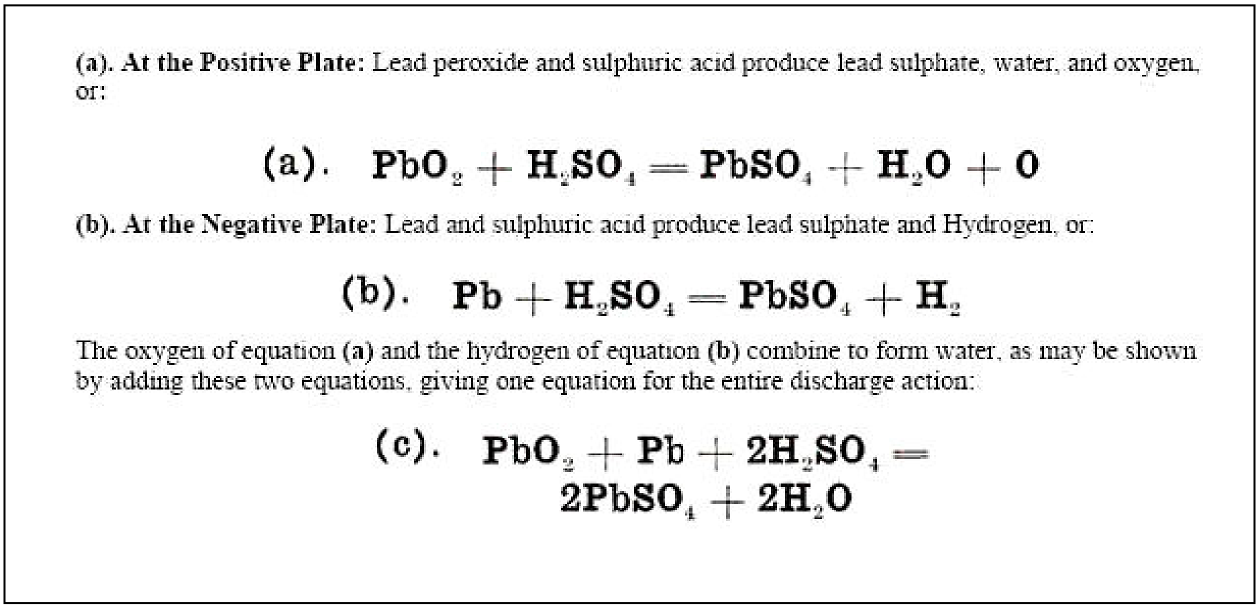
The physical construction of a battery is fairly simple. It consists of an outer, plastic case, a positive plate made of Lead Peroxide, a negative plate made of pure lead, and a liquid solution of water and acid called the electrolyte.



This diagram shows the construction of a single cell of a lead-acid battery. It produces about 2 volts. When 6 of these cells are connected together so that their voltages add up, it forms a 12 volt battery.

The term "battery" comes from the old military terminology where a group of large guns, like cannons or mortars, were arranged together to form a group. That group of guns was referred to as a "battery of guns" and its military effect was much larger than that of a single cannon or mortar. Modern electrical batteries are also more effective when multiple electro-chemical cells are used together.

The following image explains what happens when electricity is taken out of a battery. The formulas, a, b, and c, are a symbolic expression of the same information that the words are describing.



(a). At the Positive Plate: Lead peroxide and sulphuric acid produce lead sulphate, water, and oxygen, or:

$$\text{(a).}\quad PbO_2 + H_2SO_4 = PbSO_4 + H_2O + O$$

(b). At the Negative Plate: Lead and sulphuric acid produce lead sulphate and Hydrogen, or:

$$\text{(b).}\quad Pb + H_2SO_4 = PbSO_4 + H_2$$

The oxygen of equation (a) and the hydrogen of equation (b) combine to form water, as may be shown by adding these two equations, giving one equation for the entire discharge action:

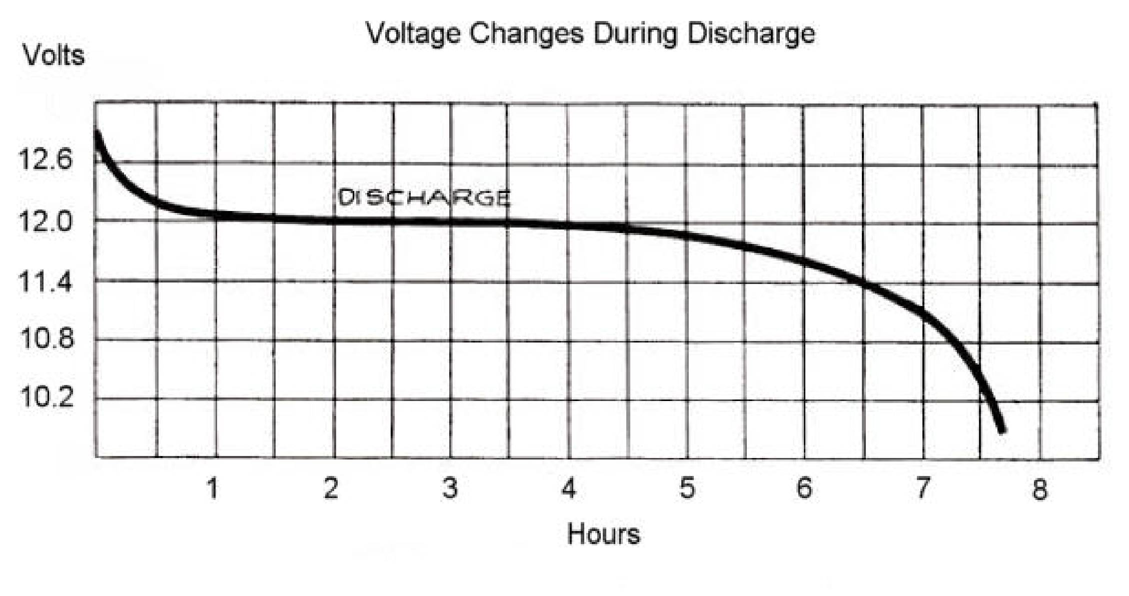
$$\text{(c).}\quad PbO_2 + Pb + 2H_2SO_4 = 2PbSO_4 + 2H_2O$$

So, what happens when electricity is taken out of a battery? The answer is expressed above in equation (c). Two molecules of the acid in the electrolyte combine with the lead materials of the positive and negative plates to form two molecules of water and two molecules of lead sulfate.

[Editors Note: The image above is taken from a book printed in 1922 where the older spelling form of the words "sulfate" and "sulfuric acid" are shown as "sulphate" and "sulphuric acid." Please don't let these spelling differences confuse you. We are talking about the same thing. Thanks.]

So, electricity becomes available to use outside of the battery when a water molecule is produced inside the battery. This is the "little secret" of the battery industry. Lead-acid batteries are essentially, a reversible "water fuel cell." The question is, how many times can this process be cycled? The answer will amaze you.

So, this is what happens to the voltage when the battery is discharged.

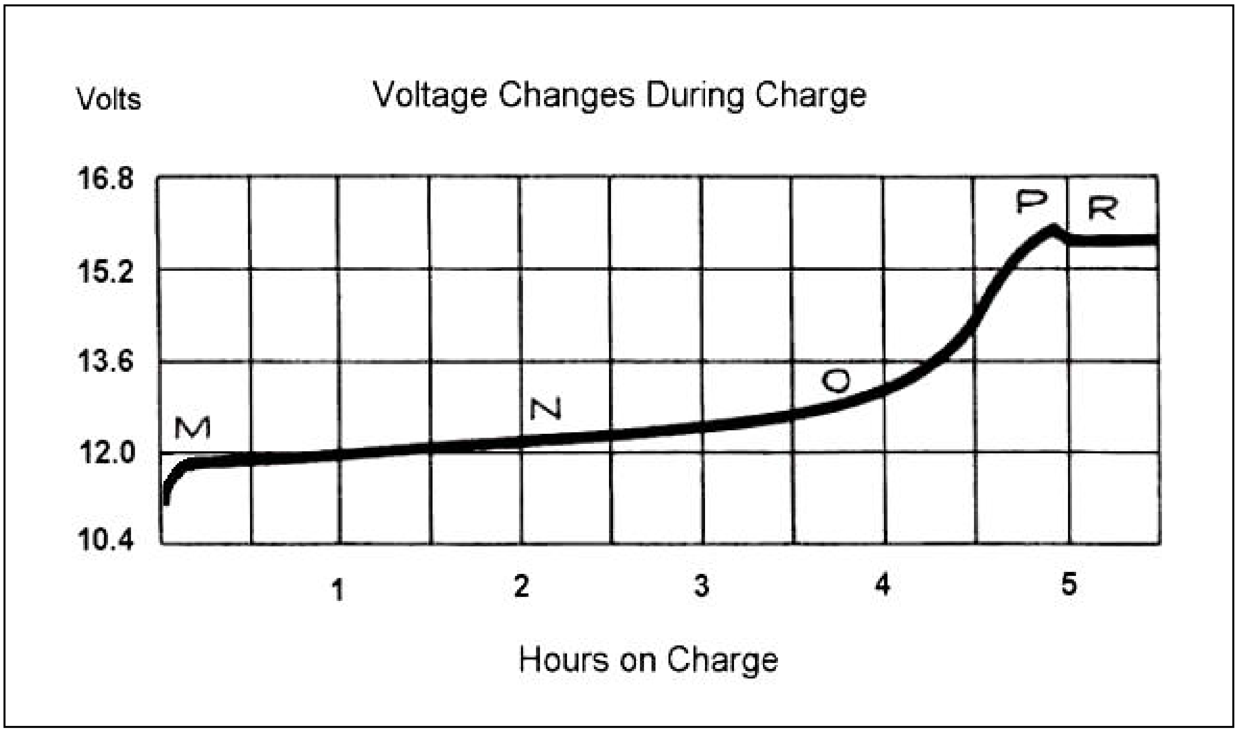


As you can see from the graph, as soon as a load is connected to the battery, its voltage drops a little. Then the voltage stabilizes and remains constant for a long time before dropping off more at the end.

The first voltage drop indicates that the chemical changes we discussed earlier have started to happen. The long, stable voltage period indicates that these chemical reactions are taking place fast enough to supply the necessary amounts of electricity to power the loads, and that there are plenty of materials available for the chemical processes to happen. When the voltage starts to drop near the end of the discharge time, this indicates that the battery is running out of acid in the electrolyte to react with the plates, and it is time to charge the battery.

Actually, there are two things happening in the battery that cause the voltage to drop. First, we have to remember what makes the voltage in the first place. The voltage is just the electrical "potential difference" that indicates the physical "chemical difference" between the positive and negative plates. When we started, the positive plate was 100% Lead Peroxide and the negative plate was 100% pure Lead. As the electrical discharge proceeds, Lead Sulfate deposits on both plates as water molecules "water down" the electrolyte. So, the battery plates are losing their "chemical difference" because the same material, Lead Sulfate, is building up on both of them. As the "chemical difference" slowly disappears, so the "electrical difference" disappears as well. And that "electrical difference" disappearing IS the voltage drop.

That is what happens when the battery discharges. OK. So, what happens when the battery is charged up again? The following graph shows what happens to the voltage when the battery is charged.



So, the voltage starts at "M" and will rise a little bit as the charge starts. How much it rises depends on the battery's condition and the strength of the charge being applied. Then, it rises very slowly through "N" until it reaches "O." This is the primary charge plateau, and most of the time during the charge will be spent here. At "O" the voltage starts rising faster until it reaches "P", which is the highest value the voltage can reach. After "P" the voltage may drop slightly to "R", indicating the charge process has finished.

As the electricity is applied to the battery to initiate the charging process, the water molecules start being broken down to produce hydrogen and oxygen again. But this is only the first step. If these gasses simply bubble out, the battery is NOT being charged.

The Oxygen must recombine with the Lead at the positive plate to produce Lead Peroxide, and these newly re-formed Lead Peroxide molecules must mechanically connect to the other Lead Peroxide material that is there. The Hydrogen must stay in the electrolyte, as a charged ion, and strip the sulfate ions out of both plates to re-form the sulfuric acid. Only when these two processes happen after the water molecule is broken down is the battery really being "charged."

From the graph you can see that the voltage of a lead-acid battery will approach 16 volts as the charging process finishes. Point "P" on the graph is the indicator that there are NO MORE sulfate ions in the plates and that 100% of the chemistry has been reversed from the last discharge.

If the charge process is stopped before point "P" is reached, it means that some sulfate ions are still left in the plates. If, for any reason, the voltage is prevented from rising to the finishing level, the charge will NOT complete.

This is another "little secret" of the battery industry. By limiting the voltage that most battery chargers provide to 14.8 volts, they know that the batteries will only last for a certain number of cycles, because a small amount of the sulfate ions are (purposely) being left in the plates at the end of each charge.

So, repeated, incomplete charging is what causes most batteries to fail. A Lead-acid battery that is charged to a finishing voltage at the end of each charge cycle can easily operate for 5,000 charge and discharge cycles, which is over 15 years of service. This is how to make your batteries last a very long time.

Finally, let's talk a little bit about battery charging "efficiency", which is really at the heart of the Bedini SG project.

In other words, "What do I have to do to charge the battery in the least amount of time, using the least amount of electricity?"

The first thing you must know is that the "state of charge" in the battery is a CHEMICAL condition, not an ENERGY condition. A completely dead battery has the same number of electrons in it as a fully charged battery!

Anything that restores the chemical condition in the battery where all of the sulfate ions are in the electrolyte and all of the free oxygen atoms are combined with the Lead on the Positive Plate **is contributing to the charging process** of the battery.

Likewise, anything that applies electricity to the battery that creates "off-gassing" or produces "heat" that warms the battery up, is wasting electricity and NOT contributing to the charging process of the battery.

John discovered that if he applied "voltage spikes" to the battery, it strongly contributed to moving the heavy, lead ions in the "charge direction" while minimizing electrical input, heat production, and off-gassing. This process was eventually referred to as "over-potentializing the electrolyte."

Editor's Note: The charts and graphs in this chapter are modified versions of materials from the book:

The Automotive Storage Battery
Its Care and Repair
(Third Edition) 1922
by O. A. Witte

For more information on efficient battery charging and the discoveries of John Bedini regarding battery rejuvenation, go here: **Battery Secrets**

Chapter Eight

Energizer Kits

With this Bedini SG manual, you have already been empowered with all the information necessary to successfully build your own energizer correctly. And the best way to learn of course is to build it all from scratch yourself. But understandably, not everyone has the time to do this and some would rather just purchase a pre-built kit that they can put together to have a fully working model in the shortest period of time.

If you happen to be one of these people who are not in a position of having the time to do it yourself, then you now have the opportunity to purchase a Bedini SG Bicycle Wheel Energizer kit, personally designed by John Bedini. It's not just built right, with all the circuitry built to his specifications, it is a beautiful, collectible work of art!

Pictures of this Kit Model are at the website listed below.

What's included…

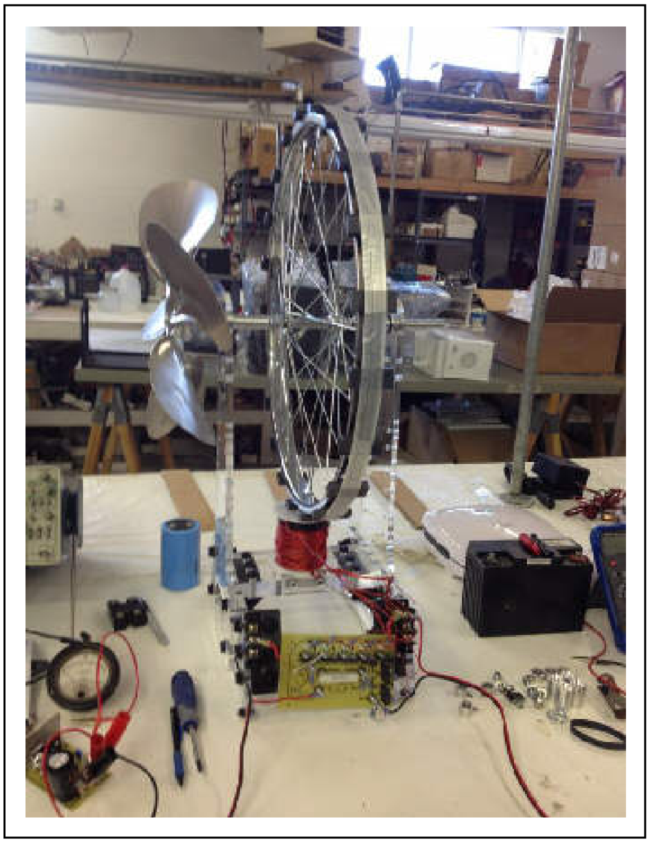
- High quality, laser cut, adjustable plastic frame that comes partially assembled. Each one has its own unique serial number with the Bedini logo engraved.
- 20" diameter steel bicycle wheel with axle extensions and bearings. This allows the entire shaft to rotate for the purpose of connecting a fan, switches, etc…
- Aluminum fan blade that you can attach to the shaft. This gives the shaft a real load demonstrating that real mechanical work is performed while moving air.
- A coil that is pre-wound with the appropriate windings around a plastic spool, with the bundled welding rod core already inserted.

- Complete circuit board with all transistors, resistors, diodes, neon bulb protection, etc… All you have to do is connect the wires from the coil to the correct places on the circuit, hook an input and output battery up and you're done.
- Batteries not included.

At the time of this writing, we have already assembled and tested the prototype. It performs even better than our highest expectations. The entire kit can be assembled and running within an hour, depending, of course, on your ability to follow simple instructions.

To learn more about these kits and to check the current availability, please visit http://www.teslachargers.com/bedinisg.html.

If you want to be one of the first to be notified when the kits are available at Tesla Chargers, sign up for the Tesla Chargers free newsletter, which is available at the top right of the Tesla Chargers website.



These Kit Energizers have a clear plastic frame, a fully assembled circuit board, a fully wound coil, a wheel with magnets, shaft extensions, bearings, and a fan. Also available, as an additional option, is a fully operational Capacitor Discharge circuit that markedly increases the battery charging process.

Assembly time is less than one hour.

Visit the website above for more details.

Appendices

United States Patents issued to John C. Bedini:

USP #6,392,370 (Re-gauging Motor) Page 84
USP #6,545,444 (Mono-Pole Motor) Page 97
USP #6,677,730 (Battery Charging Methods) Page 107
USP #7,990,110 (Advanced Battery Methods) Page 120

Article:

Attractions of Magnetism by Jeane Manning Page 131

(Reprinted by Permission)

Visit Jeane Manning's Blog at: http://changingpower.net

Photos:

Shop Models from Museum Collection Page 134

Other Resources:

Electronic Parts

Mouser Electronics	http://www.mouser.com
Radio Shack	http://www.radioshack.com

Permanent Magnets

http://www.magnet4less.com/product_info.php?cPath=2_6&products_id=255

Pick up a Magnetic Pole Indicator while you are shopping for magnets.

Magnet Wire

http://www.surplustraders.net/category/MAGNET%20WIRE-0745

A&P Electronic Media - Home of the Best collection of Information Products on the Planet! http://www.emediapress.com

Tesla Chargers - Home of "ready to use" battery chargers designed by John Bedini http://teslachargers.com

US006392370B1

(12) United States Patent
Bedini

(10) **Patent No.:** **US 6,392,370 B1**
(45) **Date of Patent:** **May 21, 2002**

(54) **DEVICE AND METHOD OF A BACK EMF PERMANENT ELECTROMAGNETIC MOTOR GENERATOR**

(75) Inventor: **John C. Bedini**, Coeur d'Alene, ID (US)

(73) Assignee: **Bedini Technology, Inc.**, Coeur d'Alene, ID (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/483,715**

(22) Filed: **Jan. 13, 2000**

(51) **Int. Cl.**^{7} **H02K 47/14**

(52) **U.S. Cl.** **318/140**; 318/492; 318/538; 310/113

(58) **Field of Search** 318/140, 148, 318/151, 153, 459, 491, 492, 538; 310/152, 156, 112, 113

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(List continued on next page.)

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WO	WO 99/38247	7/1999

Primary Examiner—Bentsu Ro
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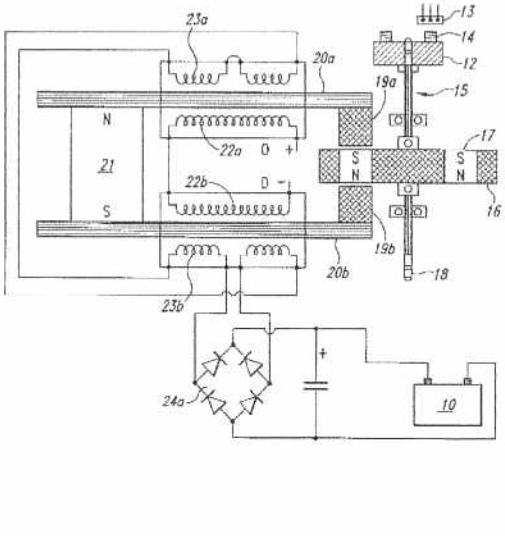
(57) **ABSTRACT**

This invention is a back EMF permanent electromagnetic motor generator and method using a regauging process for capturing available electromagnetic energy in the system. The device is comprised of a rotor with magnets of the same polarity; a timing wheel in apposition to a magnetic Hall Effect pickup switch semiconductor; and a stator comprised of two bars connected by a permanent magnet with magnetized pole pieces at one end of each bar. There are input and output coils created by wrapping each bar with a conducting material such as copper wire. Energy from the output coils is transferred to a recovery rectifier or diode. The magnets of the rotor, which is located on a shaft along with the timing wheel, are in apposition to the magnetized pole pieces of the two bars. The invention works through a process of regauging, that is, the flux fields created by the coils is collapsed because of a reversal of the magnetic field in the magnetized pole pieces thus allowing the capture of available back EMP energy. Additional available energy may be captured and used to re-energize the battery, and/or sent in another direction to be used as work. As an alternative, the available back EMF energy may be dissipated into the system.

10 Claims, 3 Drawing Sheets



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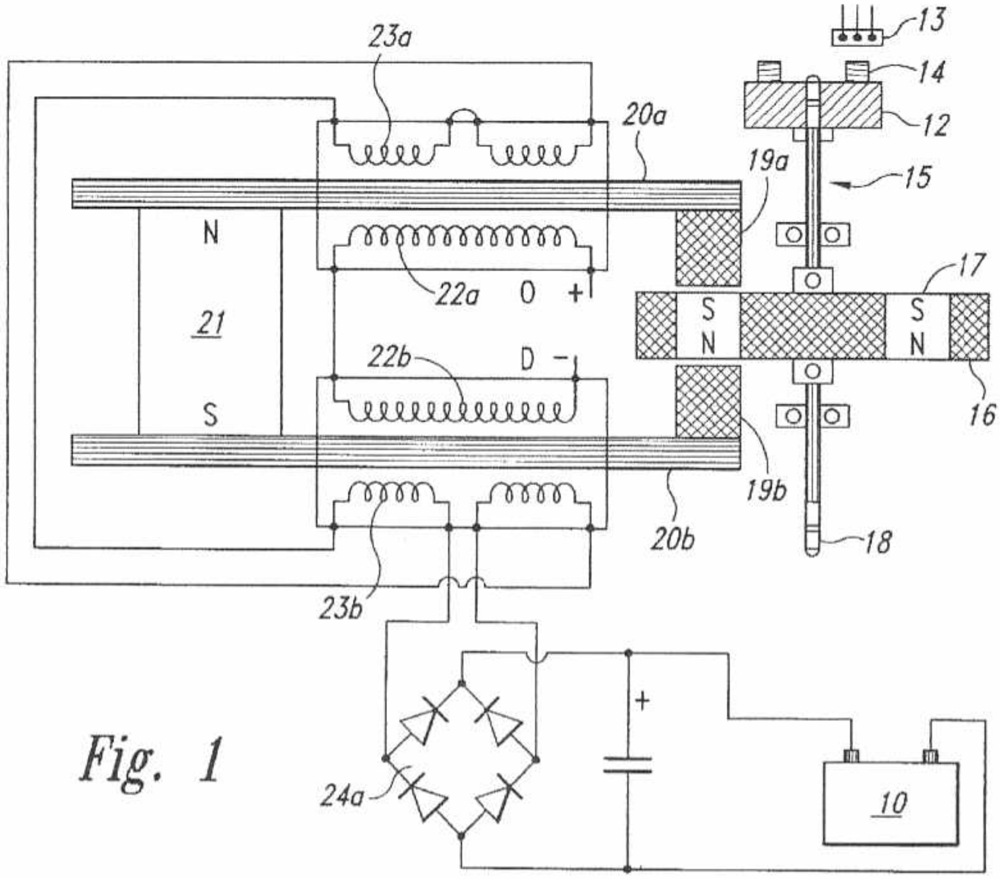


Fig. 1

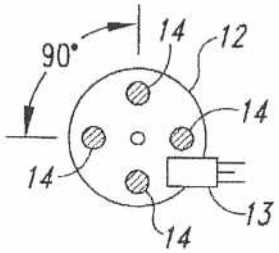


Fig. 1A

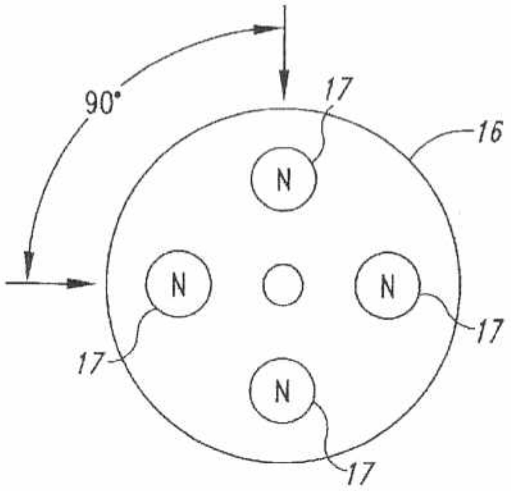


Fig. 1B

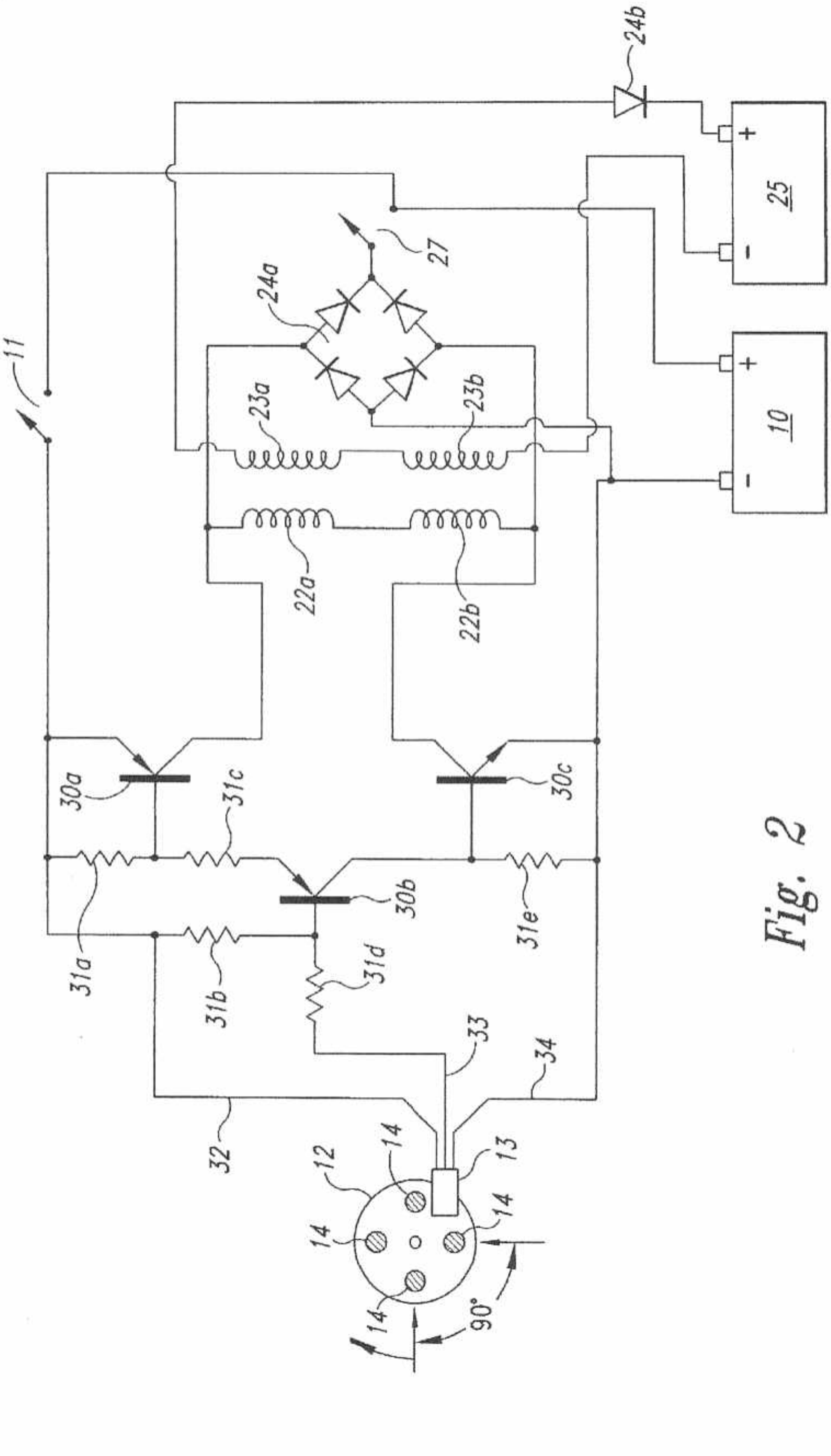
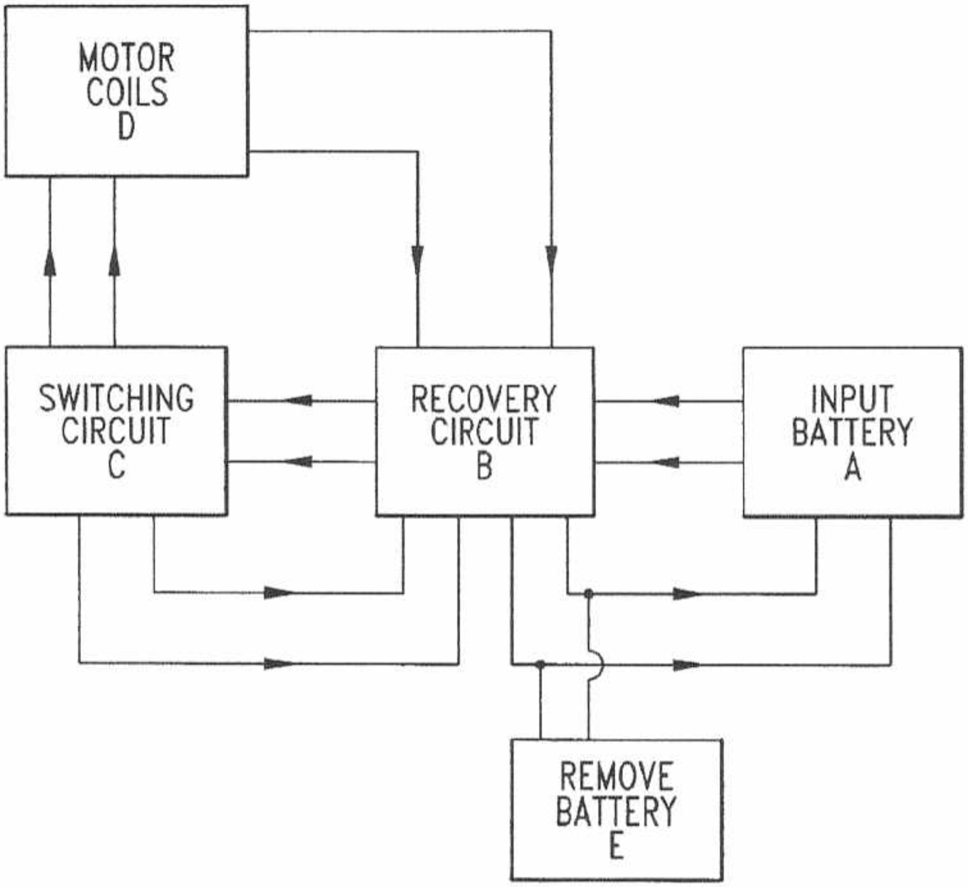

+
-
+
-
90°

Fig. 2


MOTOR
COILS
D
SWITCHING
CIRCUIT
C
RECOVERY
CIRCUIT
B
INPUT
BATTERY
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REMOVE
BATTERY
E

Fig. 3

DEVICE AND METHOD OF A BACK EMF PERMANENT ELECTROMAGNETIC MOTOR GENERATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates generally to the capturing of electromagnetic energy using a method and device to create back EMF (electromagnetic force) and re-phasing of the back EMF to recycle and capture the available back EMF energy. Back EMF is also referred to as regauging and may be defined as energy created by the magnetic field from coils, and only by coils, and not by magnets.

2. Background Information and Related Art

Operation of a normal magnetic motor has the rotor pole attracting the stator pole, resulting in the generation of power from the magnets to the rotor and flywheel. During this phase, energy flows from the magnetics to the rotor/flywheel and is stored in the increased rotation. A rotor pole leaving a stator pole and creating a condition of drag-back results in power having to be put back into the magnetic section by the rotor and flywheel to forcibly overcome the drag-back. In a perfect, friction-free motor, the net force field is therefore referred to as most conservative. In other words, a most conservative EMF motor has maximum efficiency. Without extra energy continually fed to the motor, no net work can be done by the magnetic field, since half the time the magnetic field adds energy to the load (the rotor and flywheel) and the other half of the time it subtracts energy back from the load (the rotor and flywheel). Therefore the total net energy output is zero in any such rotary process without additional energy input. To use a present day magnetic motor, continuous energy must be input into the motor to overcome drag-back and to power the motor and its load.

Present EMF motors and generators all use such conservative fields and therefore, have internal losses. Hence, it is necessary to continually input all of the energy that the motor outputs to the load, plus more energy to cover losses inside the motor itself. EMF motors are rated for efficiency and performance by how much energy input into the motor actually results in output energy to the load. Normally, the Coefficient of Performance (COP) rating is used as a measure of efficiency. The COP is the actual output energy going into the load and powering it, divided by the energy that must be input into the device with its load. COP is the power out into the load, divided by the power input into the motor/load combination. If there were zero internal losses in a motor, that "perfect" motor would have a coefficient of performance (COP) equal to 1.0. That is, all energy input into the motor would be output by the motor directly into the load, and none of the input energy would be lost or dissipated in the motor itself.

In magnetic motor generators presently in use, however, due to friction and design flaws, there are always internal losses and inefficiencies. Some of the energy input into the motor is dissipated in these internal losses. As a consequence, the energy that gets to the load is always less than the input energy. So a standard motor operates with a COP of less than 1.0 which is expressed as COP<1.0. An inefficient motor may have a COP=0.4 or 0.45, while a specially designed, highly efficient motor may have a COP=0.85.

The conservative field inside of a motor itself can be divided into two phases. Producing a conservative field involves net symmetry between the "power out" phase from the magnetics to the rotor/flywheel and the "power back in" phase from the rotor/flywheel back to the magnetics. That is, the two flows of energy (one from the magnetics into the rotor and flywheel, and one from the rotor and flywheel back to the magnetics) are identical in magnitude but opposite in direction. Each phase alone is said to be "asymmetrical"; that is, it either has: 1) a net energy flow out to the rotor/flywheel; or 2) a net energy flow back into the magnetics from the rotor/flywheel. In simplified terms, it is referred to as "power out" and "power back in" phases with respect to the motor magnetics. Hence, the two asymmetrical phases are: 1) the power-out phase; and 2) the "power back in" phase, with reference to the magnetics.

For the power-out phase, energy is derived from the EMF existing between the stator pole and incoming rotor pole in an attraction mode. In this phase, the rotary motion (angular momentum and kinetic energy) of the rotor and flywheel is increased. In short, power is added to the rotor/flywheel (and thus to the load) from the fields between stator pole and rotor pole (the electromagnetic aspects of the system).

For the "power back in" phase, energy must be fed back into the magnetics from the rotor and flywheel (and the load) to overcome the drag-back forces existing between stator pole and outgoing rotor pole. In this phase, energy is returned back to the internal magnetic system from the rotary motion of the rotor and flywheel (the angular momentum, which is the rotational energy×time). As is well known in physics, a rotor/flywheel's angular momentum provides a convenient way to store energy with the spinning rotor/flywheel mass acting as an energy reservoir.

All present day conventional magnetic motors use various methods for overcoming and partially reversing back EMF. Back EMF is the return pulse from the coil out of phase and is also referred to as regauging. The back EMF is shorted out and the rotor is attracted back in, therefore eliminating back drag. This can be accomplished by pouring in more energy, which overpowers the back EMF, thereby producing a forward EMP in that region. The energy required for this method must be furnished by the operator.

The motor of the present invention uses only a small amount of energy to "trigger" a much larger input of available energy by supplying back EMF, thus increasing the potential energy of the system. It then utilizes this excess potential energy to reduce or reverse back EMF, thereby increasing the efficiency of the motor and, therefore, the COP.

If the energy in phase 1 (the power-out phase) is increased by additional available energy in the electromagnetics themselves, then the energy in phase 1 can be made greater than the energy in phase 2 (the power-back-in phase) without the operator furnishing the energy utilized. This produces a non-conservative net field. Net power can then be taken from the rotating stator and flywheel, because the available energy added into the stator and flywheel by the additional effects, is transformed by the rotor/flywheel into excess angular momentum and stored as such. Angular momentum is conserved at all times; but now some of the angular momentum added to the flywheel is evoked by additional effects in the electromagnetics rather than being furnished by the operator.

Electrodynamicists assume that the potential available energy of any system can be changed at will and without cost. This is back EMF and is well-known in physics. It is also routinely employed by electrodynamicists in the theoretical aspects. But to simplify the mathematics, electrodynamicists will create a back EMF twice simultaneously, each back EMF carefully selected just so that the two available forces that are produced are equal and opposite and cancel each other "symmetrically". This is referred to as "symmetrical back EMF". A symmetrical back EMF system cannot produce a COP>1.0.

On the other hand, the motor of the present invention deliberately creates a back EMF itself and its potential energy only once at a time, thereby retaining each extra force for a period of time and applying it to increase the angular momentum and kinetic energy of the rotor and flywheel. Specifically, this back EMF energy with its net force is deliberately applied in the motor of the present invention to overcome and even reverse the conventional drag-back (the back EMF). Hence less energy must be taken from the rotor and flywheel to overcome the reduced back EMF, and in the ideal case none is required since the back EMF has been overpowered and converted to forward EMF by the back EMF energy and force. In the motor of the present invention, the conventional back-drag section of the magnetics becomes a forward-EMF section and now adds energy to the rotor/flywheel instead of subtracting it. The important feature is that the operator only pays for the small amount of energy necessary to trigger the back EMF, and does not have to furnish the much larger back EMF energy itself.

When the desired energy in phase 1 (the power out phase) is thus made greater than the undesired "drag-back" energy in phase 2, then part of the output power normally dragged back from the rotor and flywheel by the fields in phase 2 is not required. Hence, additional power compared to the system (without the special back EMF mechanisms) is available from the rotor/flywheel. The rotor maintains additional angular momentum and kinetic energy, compared to a system which does not produce back EMF itself. Consequently, the excess angular momentum retained by the rotor and flywheel can be utilized as additional shaft power to power an external load connected to the shaft.

A standard magnetic motor operates as the result of the motor being furnished with external energy input into the system by the operator to reduce phase 2 (power back into the magnetics from the rotor/flywheel) by any of several methods and mechanisms. The primary purpose of this external energy input into the system is to overcome the back EMF and also provide for the inevitable energy losses in the system. There is no input of energy separate from the operator input. Therefore, the COP of any standard magnetic motor is COP less than 1.0. The efficiency of a standard magnetic motor varies from less than 50% to a maximum of about 85%, and so has a COP<1.0. When nothing is done in the motor that will produce a reduction of the back EMF without the operator inputing all the energy for it, then for even a frictionless, ideal permanent magnet motor, the COP can never exceed 1.0.

Until the introduction of the motor of the present invention, it has been standard universal practice that the operator must furnish all energy used to reduce the back EMF, provide for the internal losses, and power the load. It is therefore a common belief by the scientific community that an ideal (loss-less) permanent magnet motor cannot exceed COP=1.0. And that is true, so long as the operator himself must furnish all the energy. Further, since real permanent magnetic motors have real internal losses, some of the input energy is always lost in the motor itself, and that lost energy is not available for powering the rotor/flywheel and load. Hence a real permanent magnetic motor of the conventional kind will always have a COP<1.0.

The common assumption that the COP of a motor is limited to less than 1.0 is not necessarily true, and that COP>1.0 is permitted without violating the laws of nature, laws of physics, or laws of thermodynamics. However, it can immediately be seen that any permanent magnet motor exhibiting a COP>1.0 must have some available energy input returning in the form of back EMF.

A problem relates to how back EMF energy can be obtained from a circuit's external environment for the specific task of reducing the back-drag EMF without the operator having to supply any input of that excess energy. In short, the ultimate challenge is to find a way to cause the system to: 1) become an open dissipative system, that is, a system receiving available excess energy from its environment, in other words, from an external source; and 2) use that available excess energy to reduce the drag-back EMF between stator and rotor poles as the rotor pole is leaving the stator pole. If this objective can be accomplished, the system will be removed from thermodynamic equilibrium. Instead, it will be converted to a system out-of-thermodynamic equilibrium. Such a system is not required to obey classical equilibrium thermodynamics.

Instead, an out-of-equilibrium thermodynamic system must obey the thermodynamics of open systems far from the established and well-known parameters of thermodynamic equilibrium. As is well known in the physics of thermodynamics, such open systems can permissibly: 1) self-order; 2) self-oscillate; 3) output more back EMF energy than energy input by the operator (the available excess back EMF energy is received from an external source and some energy is input by the operator as well); 4) power itself as well as its loads and losses simultaneously (in that case, all the energy is received from the available external source and there is no input energy from the operator); and 5) exhibit negentropy, that is, produce an increase of energy that is available in the system, and that is independent of the energy put into the system by the operator. As a definition, entropy roughly corresponds to the energy of a system that has become unavailable for use. Negentropy corresponds to additional energy of a system that has become available for use.

In the back EMF permanent magnet electromagnetic motor generator of the present invention, several known processes and methods are utilized which allow the invention to operate periodically as an open dissipative system (receiving available excess energy from back EMF) far from thermodynamic equilibrium, whereby it produces and receives its excess energy from a known external source.

A method is utilized to temporarily produce a much larger source of available external energy around an energized coil. Then the unique design features of this new motor provides a method and mechanism that can immediately produce a second increase in that energy, concurrently as the energy flow is reversed. Therefore, the motor is capable of producing two asymmetrical back EMFs, one after the other, of the energy within a single coil, which dramatically increases the energy available and causes that available excess energy to then enter the circuit impulsively, being collected and utilized.

The present motor utilizes this available excess back EMF energy to overcome and even reverse the back-drag EMF between stator pole and rotor pole, while furnishing only a small trigger pulse of energy necessary to control and activate the direction of the back EMF energy flow.

By using a number of such dual asymmetrical self back EMFs for every revolution of the rotor, the rotor and flywheel collectively focus all the excess impulsive inputs into increased angular momentum (expressed as energy× time), shaft torque, and shaft power.

Further, some of the excess energy deliberately generated in the coil by the utilization of the dual process manifests in the form of excess electrical energy in the circuit and is utilized to power electrical loads, e.g., a lamp, fan, motor, or other electrical devices. The remainder of the excess energy generated in the coil can be used to power the rotor and flywheel, with the rotor/flywheel also furnishing shaft horsepower for powering mechanical loads.

This new and unique motor utilizes a means to furnish the relatively small amount of energy to initiate the impulsive asymmetrical self back EMF actions. Then part of the available excess electrical power drawn off from the back EMFs is utilized to recharge the battery with dramatically increased over voltage pulses.

The unique design features of this motor utilize both north and south magnetic poles of each rotor and stator magnet. Therefore, the number of impulsive self back EMFs in a single rotation of the rotor is doubled. Advanced designs increase the number of self back EMFs in a single rotor rotation with the result that there is an increase in the number of impulses per rotation which increase the power output of this new motor.

The sharp voltage pulse produced in the coil of this new motor by the rapidly collapsing field in the back EMF coil is connected to a battery in charge mode and to an external electrical load. The net result is that the coil asymmetrically creates back EMF itself in a manner adding available energy and impulse to the circuit. The excess available energy collected in the coil is used to reverse the back-EMF phase of the stator-rotor fields to a forward EMF condition, impulsively adding acceleration and angular momentum to the rotor and flywheel. At the same time, a part of the excess energy collected in the coil is used to power electrical loads such as charging a battery and operating a lamp or such other device.

It is well known in the art that changing the voltage alone creates a back EMF and requires no work. This is because to change the potential energy does not require changing the form of that potential energy, but only its magnitude. Work is rigorously the changing of the form of energy. Therefore, as long as the form of the potential energy is not changed, the magnitude can be changed without having to perform work in the process. The motor of the present invention takes advantage of this permissible operation to create back EMF asymmetrically, and thereby change its own usable available potential energy.

In an electric power system, the potential (voltage) is changed by inputing energy to do work on the internal charges of the generator or battery. This potential energy is expended within the generator (or battery) to force the internal charges apart, forming a source dipole. Then the external closed circuit system connected to that source dipole ineptly pumps the spent electrons in the ground line back through the back EMP of the source dipole, thereby scattering the charges and killing the dipole. This shuts off the energy flow from the source dipole to the external circuit. As a consequence of that conventional method, it is a requirement to input and replace additional energy to again restore the dipole. The circuits currently utilized in most electrical generators have been designed to keep on destroying the energy flow by continually scattering all of the dipole charges and terminating the dipole. Therefore, it is necessary to keep on inputing energy to the generator to keep restoring its source dipole.

An investigation of particle physics is required to see what furnishes the energy to the external circuit. Since neither a battery nor a generator furnishes energy to the external circuit, but only furnishes energy to form the source dipole, a better understanding of the electric power principle is required to fully understand how this new motor functions. A typical battery uses its stored chemical energy to form the source dipole. A generator utilizes its input shaft energy to rotate, forming an internal magnetic field in which the positive charges are forced to move in one direction and the negative charges in the reverse direction, thereby forming the source dipole. In other words, the energy input into the generator does nothing except form the source dipole. None of the input energy goes to the external circuit. If increased current is drawn into the external load, there also is increased spent electron flow being rammed back through the source dipole, destroying it faster. Therefore, dipole-restoring-energy has to be inputed faster. The chemical energy of the battery also is expended only to separate its internal charges and form its source dipole. Again, if increased current and power is drawn into the external load, there is increased spent electron flow being rammed back through the source dipole, destroying it faster. This results in a depletion of the battery's stored energy faster, by forcing it to have to keep restoring the dipole faster.

Once the generator or battery source dipole is formed (the dipole is attached also to the external circuit), it is well known in particle physics that the dipole (as is any charge) is a broken symmetry in the vacuum energy flux. By definition, this means that the source dipole extracts and orders part of that energy received from its vacuum interaction, and pours that energy out as the energy flowing through all space surrounding the external conductors in the attached circuit. Most of this enormous energy flow surging through space surrounding the external circuit does not strike the circuit at all, and does not get intercepted or utilized. Neither is it diverged into the circuit to power the electrons, but passes on out into space and is just "wasted". Only a small "sheath" of the energy flow along the surface of the conductors strikes the surface charges in those conductors and is thereby diverged into the circuit to power the electrons. Standard texts show the huge available but wasted energy flow component, but only calculate the small portion of the energy flow that strikes the circuit, is caught by it, and is utilized to power it.

In a typical circuit, the huge available but "wasted" component of the energy flow is about 10^{13} times as large as is the small component intercepted by the surface charges and diverged into the circuit to power it. Hence, around every circuit and circuit element such as a coil, there exists a huge non-intercepted, non-diverged energy flow that is far greater than the small energy flow being diverted and used by the circuit or element.

Thus there exists an enormous untapped energy flow immediately surrounding every EMF power circuit, from which available excess energy can be intercepted and collected by the circuit, if respective non-linear actions are initiated that sharply affect and increase the reaction cross section of the circuit (i.e., its ability to intercept this available but usually wasted energy flow).

The method in which the motor of the present invention alters the reaction cross section of the coils in the circuit, is by a novel use, which momentarily changes the reaction cross section of the coil in which it is invoked. Thus, by this new motor using only a small amount of current in the form of a triggering pulse, it is able to evoke and control the immediate change of the coil's reaction cross section to this normally wasted energy flow component. As a result, the motor captures and directs some of this usually wasted environmental energy, collecting the available excess energy in the coil and then releasing it for use in the motor. By timing and switching, the innovative gate design in this new motor directs the available excess energy so that it overcomes and reverses the return EMF of the rotor-stator pole combination during what would normally be the back EMF and demonstrates the creation of the second back EMF of the system. Now instead of an "equal retardation" force being produced in the back EMF region, a forward EMF is produced that is additive to the rotor/flywheel energy and not subtractive. In short, it further accelerates the rotor/flywheel.

This results in a non-conservative magnetic field along the rotor's path. The line integral of the field around that path (i.e., the net work on the rotor/flywheel to increase its energy and angular momentum) is not zero but a significant amount. Hence, the creation of an asymmetrical back EMF impulse magnetic motor: 1) takes its available excess energy from a known external source, the huge usually non-intercepted portion of the energy flow around the coil; 2) further increases the source dipolarity by this back EMF energy; and 3) produces available excess energy flow directly from the source dipole's increased broken symmetry in its fierce energy exchange with the local vacuum.

No laws of physics or thermodynamics are violated in the method and device of the present invention, and conservation of energy rigorously applies at all times. Nonetheless, by operating as an open dissipative system not in thermodynamic equilibrium with the active vacuum, the system can permissibly receive available excess energy from a known environmental source and output more energy to a load than must be input by the operator alone. As an open system not in thermodynamic equilibrium, this new and unique motor can tap in on back EMF to energize itself, loads and losses simultaneously, fully complying with known laws of physics and thermodynamics.

A search of prior art failed to reveal any devices that recycle available energy from back EMF of a permanent electromagnetic motor generator as described in the present invention. However, the following prior art patents were reviewed:

1. U.S. Pat. No. 5,532,532 to DeVault, et al., Hermetically Sealed Super-conducting Magnet Motor.
2. U.S. Pat. No. 5,508,575 to Elrod, Jr., Direct Drive Servovalve Having Magnetically Loaded Bearing.
3. U.S. Pat. No. 5,451,825 to Strohm, Voltage Homopolar Machine.
4. U.S. Pat. No. 5,371,426 to Nagate et al., Rotor For Brushless Motor.
5. U.S. Pat. No. 5,369,325 to Nagate et al., Rotor For Brushless Electromotor And Method For Making Same.
6. U.S. Pat. No. 5,356,534 to Zimmermann, deceased et al., Magnetic-Field Amplifier.
7. U.S. Pat. No. 5,350,958 to Ohnishi, Super-conducting Rotating Machine, A Super-conducting Coil, And A Super-conducting Generator For Use In A Lighting Equipment Using Solar Energy.
8. U.S. Pat. No. 5,334,894 to Nakagawa, Rotary Pulse Motor.
9. U.S. Pat. No. 5,177,054 to Lloyd, et al., Flux Trapped Superconductor Motor and Method.
10. U.S. Pat. No. 5,130,595 to Arora, Multiple Magnetic Paths Pulse Machine.
11. U.S. Pat. No. 4,980,595 to Arora, Multiple Magnetics Paths Machine.
12. U.S. Pat. No. 4,972,112 to Kim, Brushless D.C. Motor.
13. U.S. Pat. No. 4,916,346 to Kliman, Composite Rotor Lamination For Use In Reluctance Homopolar, And Permanent Magnet Machines.
14. U.S. Pat. No. 4,761,590 to Kaszman, Electric Motor.
15. U.S. Pat. No. 4,536,230 to Landa, et al., Anisotropic Permanent Magnets.
16. U.S. Pat. No. Re. 31,950 to Binns, Alternating Current Generators And Motors.
17. U.S. Pat. No. 4,488,075 to DeCesare, Alternator With Rotor Axial Flux Excitation.
18. U.S. Pat. No. 4,433,260 to Weisbord et al., Hysteresis Synchronous Motor Utilizing Polarized Rotor.
19. U.S. Pat. No. 4,429,263 to Muller, Low Magnetic Leakage Flux Brushless Pulse Controlled D-C Motor.
20. U.S. Pat. No. 4,423,343 to Field, II, Synchronous Motor System.
21. U.S. Pat. No. 4,417,167 to Ishii et al., DC Brushless Motor.
22. U.S. Pat. No. 4,265,754 to Menold, Water Treating Apparatus and Methods.
23. U.S. Pat. No. 4,265,746 to Zimmermann, Sr. et al. Water Treating Apparatus and Methods.
24. U.S. Pat. No. 4,222,021 to Bunker, Jr., Magnetic Apparatus Appearing To Possess a Single Pole.
25. U.S. Pat. No. 2,974,981 to Vervest et al., Arrester For Iron Particles.
26. U.S. Pat. No. 2,613,246 to Spodig, Magnetic System.
27. U.S. Pat. No. 2,560,260 to Sturtevant et al., Temperature Compensated Magnetic Suspension.

SUMMARY OF THE INVENTION

The device and method of the present invention is a new permanent electromagnetic motor generator that recycles back EMF energy (regauging) thus allowing the motor to produce an energy level of COP=0.98, more or less, depending upon configuration, circuitry, switching elements and the number and size of stators, rotors and coils that comprise the motor. The rotor is fixed between two pole pieces of the stator. The motor generator is initially energized from a small starter battery means, analogous to a spark plug, that sends a small amount of energy to the motor, thus stimulating a rotating motion from the rotor. As the rotor rotates, energy is captured from the surrounding electromagnetic field containing an asymmetrical pulse wave of back EMF. The energy produced and captured can be directed in one of several directions, including returning energy to the initial starter battery, rotating a shaft for work and/or sending a current to energize a fan, light bulb or other such device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top perspective view of a back EMF permanent electromagnetic motor generator with a single stator and a single rotor.

FIG. *1a* is a side perspective view of a timing wheel and magnetic Hall Effect uptake switch of the back EMF motor generator.

FIG. *1b* is a side perspective view of the rotor of the back EMF motor generator.

FIG. **2** is a schematic drawing incorporating circuitry for the back EMF motor generator.

FIG. **3** is a box diagram showing the relationships of the back EMF motor generator circuitry.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is a device and method for creating a back EMF permanent electromagnetic motor generator. As described in the Background Information, this new motor generator conforms to all applicable electrodynamic laws of physics and is in harmony with the law of the conservation of energy, the laws of electromagnetism and other related natural laws.

The back EMF permanent electromagnetic motor generator is comprised of combination of electrical, material and magnetic elements to capture available electromagnetic energy (back EMF) in a recovery rectifier or single diode from output coils. The capturing of back EMF energy is also known as regauging in the art. As an arbitrary starting point in describing this invention, an input battery, as a means of energy, sends power through a power on-off switch and then to a means for timing such as a magnetic timing switch (Hall Effect magnetic pickup switch, a semiconductor) which interfaces with or is in apposition to a magnet on a timing wheel. The timing wheel may contain any number of magnets of one or more, with the South polarity facing outward and in apposition with the Hall Effect pickup switch. The timing wheel is mounted at the end of a shaft that also runs through the center midline of a rotor containing any number of magnets of two or more. The rotor magnets are arranged in a manner wherein they have the same polarity and are equidistant from each other. The shaft has the timing wheel mounted at one end, the rotor, and then a means for work, such as a power take off at the opposite end. However, there are other embodiments in which the position of the rotor, timing wheel and power take-off have other arrangements. The rotor is stabilized to a platform or housing means and is fixed in a stationary position within a stator.

The stator is comprised of a permanent magnet connected to a means for conducting electromagnetic energy such as two parallel bars, each bar having a magnetized pole piece at one end of each bar. The conduction material of the bar may be ferrous, powdered iron, silicon steel, stainless magnetic steel, laminations of conductive material or any other magnetic conductive material. Each bar is wrapped in a conducting means to form an input coil. The means for conducting may be copper, aluminum or any other conductive material suitable for making a coil. The primary or input coil is connected to the switching circuit. A second conductive wrapping on top of the input coil becomes a secondary or output coil. The secondary or output coil is connected to the recovery circuit. The rotor is symmetrically located between the pole pieces of the bars of the stator and contains a series of magnets all having the same polarity, North or South, with each magnet in the rotor being in apposition to the pole piece as the rotor is in rotation around the shaft.

When the rotor is energized from the battery of the switching circuit, there is an initial magnetic field that is instantly overcome as the magnetized pole pieces are in apposition with the rotor magnets. As the rotor begins to move, increasing electromagnetic energy is produced as a result of flux gaiting from the apposed magnets of the rotor and pole pieces. The coils surrounding the bars "buck" the permanent magnet connecting the bars. This is known in the art as the "buck boosting" principle. When the permanent magnet is bucked by the coils, it reverses the polarity of the pole pieces which are apposed to the rotor magnets causing the rotor to increase its rotation or spin. The energy available from the fields that are collapsing in the primary and secondary coils, which creates the back EMF within the system, is now in non-equilibrium. Through circuitry and a switching means, energy can be put back into the system. Available energy captured from the back EMF, may be applied in different directions, including re-energizing the input battery, storage in a capacitor, conversion by a recovery rectifier to be stored in the input battery, a capacitor or a secondary or recovery battery. Recovery rectifiers convert AC to DC. Available energy may be used to energize an electric bulb, fan or any other uses.

The shaft in the midline of the rotor can transfer energy in the form of work through a power take-off. The power take-off may be connected to any number of secondary shafts, wheels, gears and belts to increase or reduce torque.

This is a description of the basic invention, however, there are an innumerable number of combinations and embodiments of stators, rotors, Hall Effect magnetic pickup switches, coils, recovery rectifiers and electronic connecting modes that may be combined on a single shaft or several shafts connected in various combinations and sequences, and of various sizes. There may be any number of stators to one rotor, however, there can be only one rotor if there is a single stator. The number of Hall Effect pickup switches may vary, for example, in the case of multiple stators of high resistant coils, the coils may be parallel to form a low resistant coil so that one Hall Effect pickup with one circuit may fire all of the stators at the same time. The number of magnets in both the timing wheel and the rotor may also vary in number as well as the size and strength of the magnets in gauss units. All types of magnets may be used. The number of winds on both the input and output coils on each conducting bar may also vary in number and in conductive material.

The motor generator, as shown in FIG. **1**, a top perspective view of a single stator, single rotor back EMF motor and is comprised of a means of providing energy, such as input battery **10** connected to power switch **11** (shown in FIG. **2**) and Hall Effect magnetic pickup switch **13**. Magnetic pickup **13** interfaces with timing wheel **12** to form a timing switch. Timing wheel **12** is comprised of four magnets **14** with the South pole of each said magnet facing outward to magnetic pickup **13**. Timing wheel **12** is fixed at one end of shaft **15**. Located on shaft **15** is rotor **16**. Rotor **16** can be of any size, said rotor containing four rotor magnets **17**. Said rotor magnets **17** are arranged in a manner so all have the same polarity. Opposite timing wheel **12** on shaft **15** is a means for work, such as a power take-off **18**. Rotor **16** is mounted in a fixed position with rotor magnets **17** in apposition with magnetized pole pieces **19***a* and **19***b*. Each pole piece **19***a* and **19***b* is connected to iron bars **20***a* and **20***b*. Iron bars **20***a* and **20***b* are connected by a permanent magnet **21**. A means for conduction is wrapped around iron bars **20***a* and **20***b* to form input coils **22***a* and **22***b*. Superimposed upon input coils **22***a* and **22***b* are output coils **23***a* and **23***b*. Output coils **23***a* and **23***b* are connected to full wave bridge first recovery rectifier **24***a*. First rectifier **24***a* is connected to battery **10**.

FIG. **1***a* is a perspective side view of the back EMF Motor Generator timing wheel **12** with Hall Effect magnetic pickup switch **13** in apposition individually to each of four magnets **14** as said timing wheel **12** rotates. Said magnets **14** have the South polarity facing outward with an equidistant separation of 90°.

FIG. **1***b* is a perspective side view of rotor **16** with four rotor magnets **17** with 900 equidistant separation and having the same polarity.

FIG. **2** is a schematic diagram of the motor generator circuitry showing input coil connections from input battery

10 through power switch **11**, transistors **30***a,b*, resistors **31***a–d*, through power supply lead **32** (VCC+) and to magnetic pickup **13**. Magnetic pickup **13** is in apposition with timing wheel magnets **14** located on timing wheel **12**. Off of magnetic pickup **13** is collector lead **33** and ground lead **34**. When current is reversed, it flows through resistor **31***e* and transistor **30***c* to input battery **10**. Input coils **22***a,b* send power to full wave bridge first recovery rectifier **24***a* which then sends power through switch recovery **27** back into the system, and/or to input battery **10**. Output coils **23***a* and **23***b* send power through single diode second recovery rectifier **24***b* to recovery battery **25**. In this particular embodiment, the value and type number of the components are as follows: Hall Effect magnetic pickup switch **13** is a No. 3020; transistor **30***a* is a No. 2N-2955; transistor **30***b* is a No. MPS-8599; and transistor **30***c* is a No. 2N-3055; resistors **31***a* and b are 470 ohms resistors; resistor **31***b* is a 2.2 K ohms resistor; resistor **31***c* is a 220 ohms resistor; resistor **31***d* is a 1 K ohms resistor; and recovery rectifier **24***a* is a 10 Amp, 400 volts bridge rectifier.

FIG. **3** is a box diagram showing the flow of voltage from input battery A, through recovery circuit B, switching circuit C and motor coils D. Motor coils D send available back EMF energy through recovery circuit B, and from B to recovery battery E and input battery A. Available back EMF energy can also flow from switching circuit C to recovery circuit B.

In multiple stator/rotor systems, each individual stator may be energized one at a time or all of the stators may be energized simultaneously. Any number of stators and rotors may be incorporated into the design of such multiple stator/rotor motor generator combinations. However, while there may be several stators per rotor, there can only be one rotor for a single stator. The number of stators and rotors that would comprise a particular motor generator is dependent upon the amount of power required in the form of watts. The desired size and horse power of the motor determines whether the stators will be in parallel or fired sequentially by the magnetic Hall Effect pickup switch or switches. The number of magnets incorporated into a particular rotor is dependent upon the size of the rotor and power required of the motor generator. In a multiple stator/rotor motor generator, the timing wheel may have one or more magnets, but must have one magnet Hall Effect pickup switch for each stator if the stators are not arranged in parallel. The back EMF energy is made available through the reversing of the polarity of the magnetized pole pieces thus collapsing the field around the coils and reversing the flow of energy to the recovery diodes, which is capturing the back EMF.

Individual motors may be connected in sequence with each motor having various combinations of stators and rotors or in parallel. Each rotor may have any number of rotor magnets ranging from a minimum of 2 to maximum of 60. The number of stators for an individual motor may range from 1 to 60 with the number of conducting bars ranging from 2 to 120.

What distinguishes this motor generator from all others in the art is the presence of a permanent magnet connecting the two conducting bars which transfer magnetic energy through the pole pieces to the rotor, thereby attracting the rotor between the pole pieces. With the rotor attracted in between the two pole pieces, the coils switch the polarity of the magnetic field of the pole pieces so that the rotor is repelled out. Therefore there is no current and voltage being used to attract the rotor. The only current being used is the repulsion of the rotor between the two conductive bar pole pieces thereby requiring only a small amount of current to repel the rotor. This is known as a regauging system and allows the capturing of available back EMF energy for use.

Finally, although the invention has been described with reference of particular means, materials and embodiments, it is to be understood that the invention is not limited to the particulars disclosed and extends to all equivalents within the scope of the claims.

What is claimed is:

1. A back EMF permanent electromagnetic motor generator using a regauging process for capturing available electromagnetic energy in the system comprising:

a. a means for producing a source of input energy to said motor generator, said energy conducted through a power switch and a magnetic timing switch;

b. a means for timing said motor generator, having a timing wheel connected to a shaft, said timing wheel comprised of one or more magnets, said magnets arranged so that the South polarity faces outward and is in apposition with said timing switch;

c. a rotor and a means for transferring a force on said shaft, said rotor containing magnets having the same polarity;

d. a stator comprised of two bars made of a magnetic conductive means, said bars connected by a permanent magnet and having a pole piece at one end of each said bar, said pole pieces thereby magnetized and in apposition with magnets of said rotor, said rotor positioned between said pole pieces;

e. an input coil comprised of a conductive material wrapped around each of said bars of said stator, said input coil connected to a circuit;

f. an output coil comprised of a conductive material wrapped around each of said input coil of said bars, said output coils connected to a recovery rectifier or diode;

g. said circuit for transferring electrical power, said circuit connecting said means for producing input energy to said power switch, said circuit comprising a pickup timing switch thereby providing an electronic voltage pulse to said circuit and then to said coils resulting in rotation of said rotor, said rotor turning said timing wheel to provide additional electronic voltage pulses to said circuit and then to said coils again, thereby providing a means for collecting available back EMF energy for storage, use or dissipation into the system.

2. The motor generator of claim **1**, wherein said input producing means is a battery.

3. The motor generator of claim **1**, wherein said magnetic timing switch is a Hall Effect magnetic pickup semiconductor.

4. The motor generator of claim **1**, wherein the number of rotors may range from 1 to 60.

5. The motor generator of claim **1**, wherein the number of magnets in said rotor has a range of 2 to 60.

6. The motor generator of claim **1**, wherein said magnetic conductive means may be ferrous, powdered iron, silicon steel, stainless magnetic steel, laminations of a conductive material or any other magnetic conductive material.

7. The motor generator of claim **1**, wherein the number of magnetic conductive bars has a range of 2 to 120.

8. The motor generator of claim **1**, wherein said means for transferring a force on said shaft may be a power take-off mechanism, gears, flywheels, belts or other methods of transferring force for the purpose of doing work.

9. A back EMF permanent electromagnetic motor generator using a regauging process for capturing available electromagnetic energy in the system comprising:

a. a battery connected to a power switch and a Hall Effect magnetic pickup switch, said magnetic pickup switch in apposition with a timing wheel, said timing wheel on a shaft;

b. a rotor and a power take-off means on said shaft, said rotor having four magnets of the same polarity, said magnets equidistant from each other;

c. a stator, said stator comprised of two iron bars connected by a permanent magnet and wrapped in a first copper conducting material to form an input coil that is connected to a circuit, on top of said input coil, there is wrapped a second copper conducting material to form an output coil with said output coil connected to a recovery rectifier or single diode, said iron bars further having a pole piece at one of each end of said bars, said pole pieces in apposition to said magnets on said rotor;

d. a circuit for transferring electrical power, said circuit connecting said battery to said power switch, said circuit comprising-said Hall Effect pickup switch thereby providing an electronic voltage pulse through said circuit and then to said coils resulting in rotation of said rotor, said rotor turning said timing wheel to provide additional electronic voltage pulses to said coils again, thereby providing a means for collecting available back EMF energy for storage, use or dissipation into the system.

10. A method of producing a back EMF permanent electromagnetic motor generator using a regauging process comprising the steps of:

a. placing a rotor containing magnets of the same polarity on a shaft with a timing wheel on said shaft;

b. placing in apposition to said timing wheel a Hall Effect magnetic pickup switch;

c. placing in apposition to said magnets of said rotor magnetized pole pieces of a stator, said stator comprised of two conducting bars connected by a permanent magnet; input coil connected a circuit;

e. on top of said input coil, wrapping a second conducting material to form an output coil, said output coil connected to a recovery rectifier or a single diode;

f. connecting a circuit for transferring electrical power, said circuit connected to a battery and a power switch, said circuit comprising said Hall Effect magnetic pickup switch thereby providing an electronic voltage pulse to said circuit and then to said coils resulting in increase rotation of said rotor, said rotor turning said timing wheel to provide additional electronic pulses to said circuit and then to said coils again, thereby providing a means for collecting available back EMF energy for storage, use or dissipation into the system.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,392,370 B1
DATED : May 21, 2002
INVENTOR(S) : John C. Bedini

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 13,
Line 19, please delete the hyphen in between "comprising" and "said" and insert a space.

Column 14,
Line 11, after the semicolon, please delete "input coil connected a circuit;".
Line 12, please insert the following new paragraph:
-- d. wrapping said bars with a first conducting material to form an input coil, said input coil connected to a circuit --.

Signed and Sealed this

Tenth Day of December, 2002

JAMES E. ROGAN
Director of the United States Patent and Trademark Office

US006545444B2

(12) United States Patent
Bedini

(10) **Patent No.: US 6,545,444 B2**
(45) **Date of Patent: Apr. 8, 2003**

(54) **DEVICE AND METHOD FOR UTILIZING A MONOPOLE MOTOR TO CREATE BACK EMF TO CHARGE BATTERIES**

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(73) Assignee: **Bedini Technology, Inc.**, Coeur D'Alene, ID (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/805,762**

(22) Filed: **Mar. 13, 2001**

(65) **Prior Publication Data**

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(51) **Int. Cl.**^{7} **H02P 5/28**

(52) **U.S. Cl.** **318/798**; 318/434; 318/138; 318/801; 318/802; 318/364; 318/139; 318/146; 318/806; 318/459

(58) **Field of Search** 318/798, 434, 318/138, 801, 802, 364, 134, 146, 806, 459; 388/928.1

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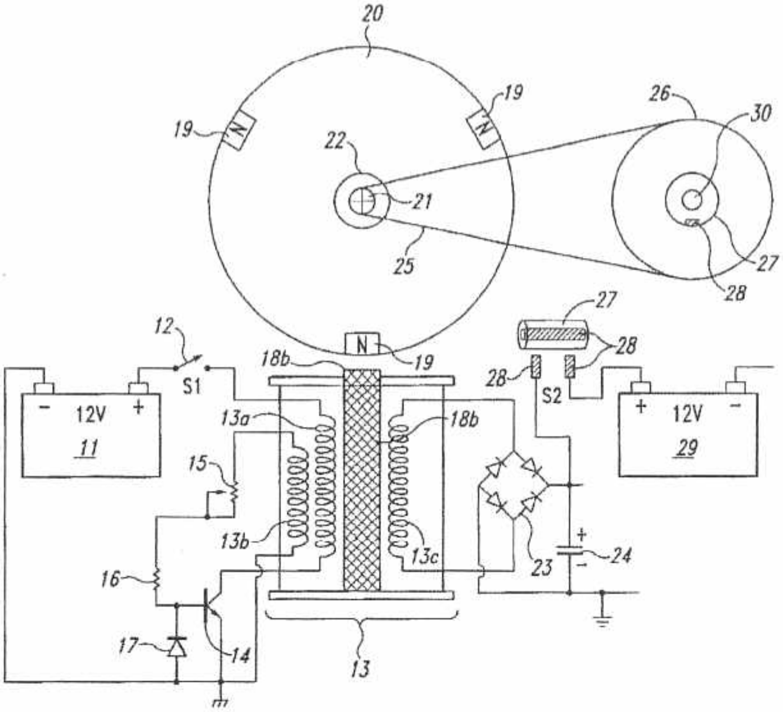
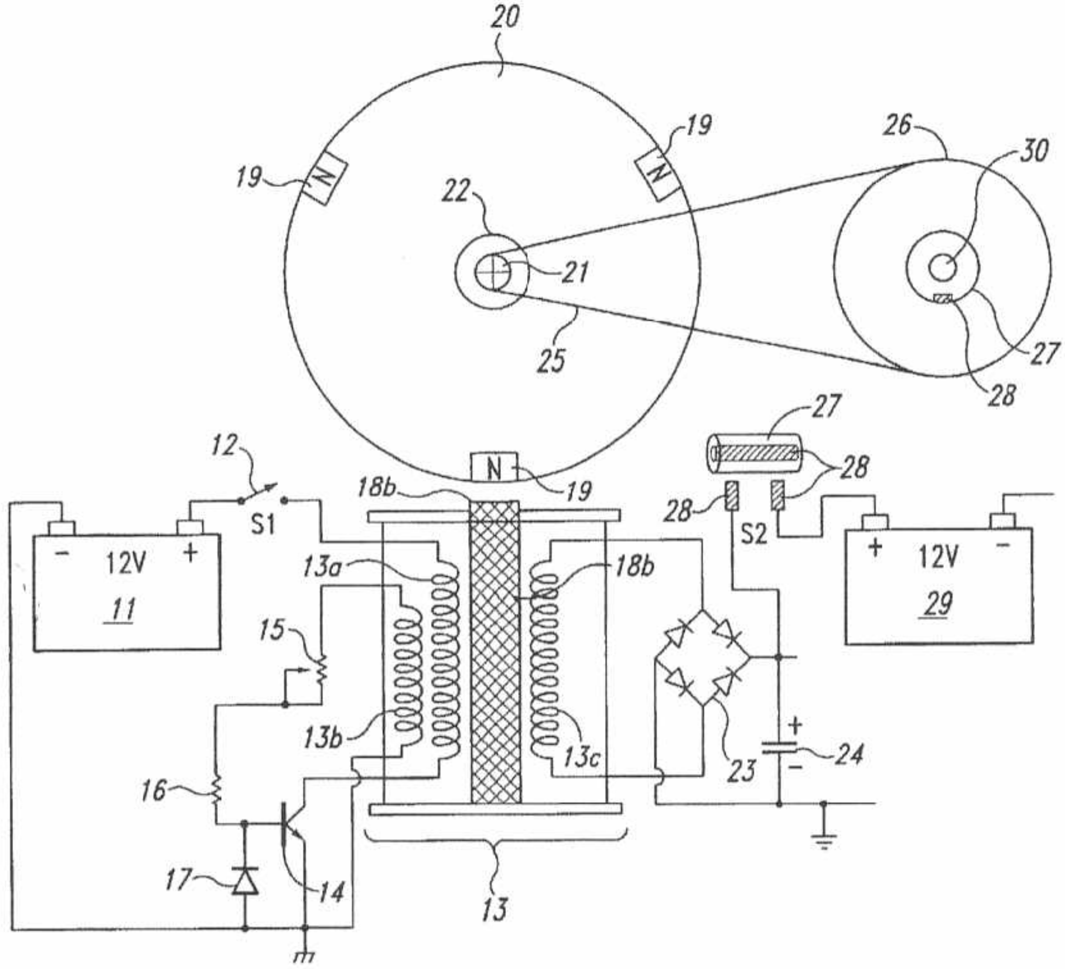
(74) *Attorney, Agent, or Firm*—Graybeal Jackson Haley LLP

(57) **ABSTRACT**

A back EMF monopole motor and method using a rotor containing magnets all of the same polarity and in a monopole condition when in momentary apposition with a magnetized pole piece of a stator having the same polarity, said stator comprised of a coil with three windings: a power-coil winding, a trigger-coil winding, and a recovery-coil winding. The back EMF energy is rectified using a high voltage bridge, which transfers the back EMF energy to a high voltage capacitor for storage in a recovery battery. The stored energy can then be discharged across the recovery battery through the means of a contact rotor switch for further storage.

10 Claims, 3 Drawing Sheets




N
N
S1
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S2
12V
12V

Fig. 1

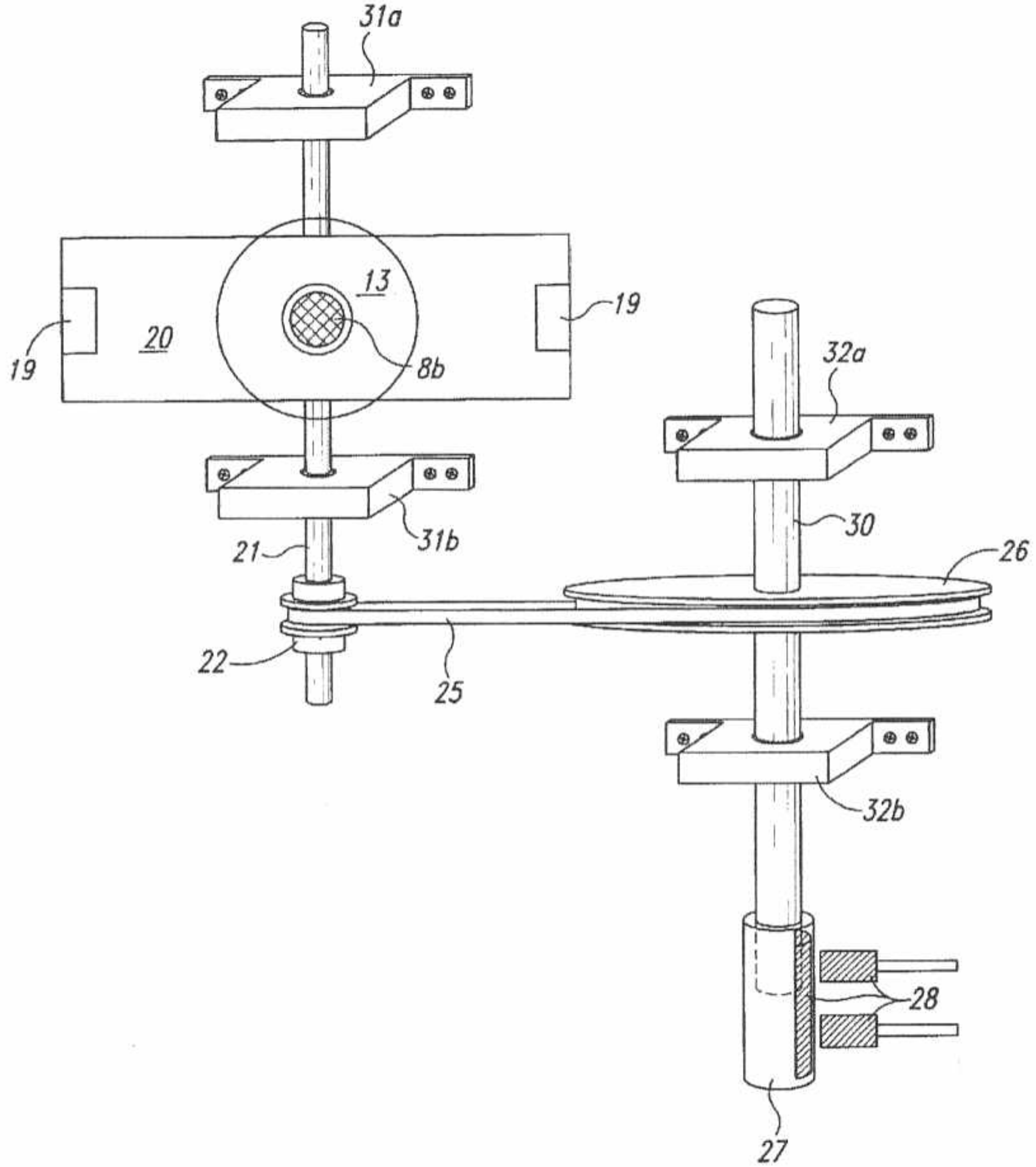

Fig. 2

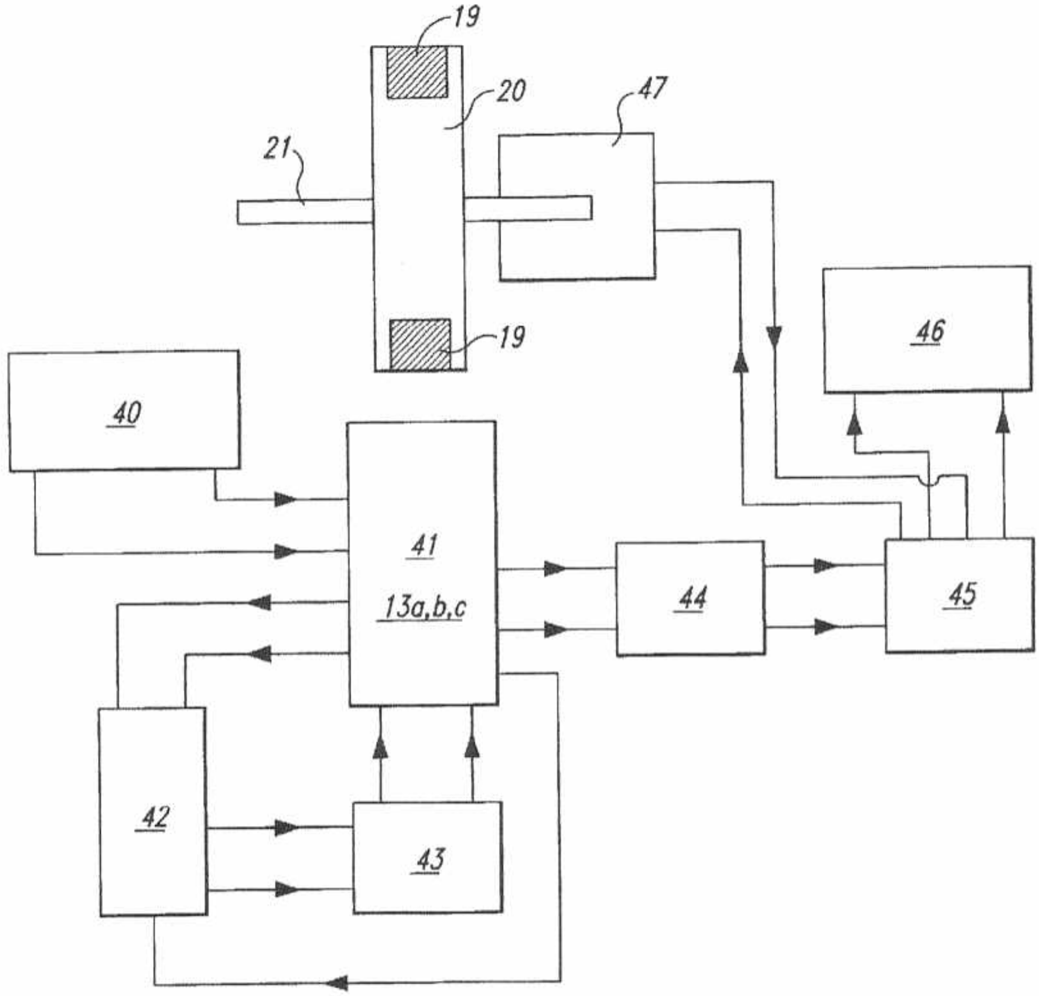

Fig. 3

DEVICE AND METHOD FOR UTILIZING A MONOPOLE MOTOR TO CREATE BACK EMF TO CHARGE BATTERIES

TECHNICAL FIELD

The invention relates generally to the capturing of available electromagnetic energy using a device and method for creating an electromagnetic force (hereinafter, EMF) and then using the available stored energy for recycling into the system as stored energy. The method of creating back EMF is the result of coupling/uncoupling a voltage source to and from a coil.

BACKGROUND

Operation of present day normal magnetic motors has the rotor pole attracting the stator pole, resulting in the generation of mechanical power from the magnets to the rotor and flywheel. During this phase, energy flows from the magnetics to the rotor/flywheel and is stored as kinetic energy in the increased rotation. A rotor pole leaving a stator pole and creating a condition of "drag" results in power having to be put back into the magnetic section by the rotor and flywheel to forcibly overcome the drag. In a perfect, friction-free motor, the net force field is therefore referred to as "most conservative". A most conservative EMF motor has maximum efficiency. Without extra energy continually fed to the motor, no net work can be done by the magnetic field, since half the time the magnetic field adds energy to the load (the rotor and flywheel) and the other half of the time it subtracts energy back from the load (the rotor and flywheel). Therefore, the total net energy output is zero in any such rotary process without additional energy input. To use a present day magnetic motor, continuous energy must be input into the motor to overcome drag and to power the motor and its load.

Motors and generators presently in use, all use such conservative fields and therefore, have internal losses. Hence, it is necessary to continually input all of the energy that the motor outputs to the load, plus more energy to cover losses inside the motor itself. EMF motors are rated for efficiency and performance by how much energy "input" into the motor actually results in "output" energy to the load. Normally, the Coefficient of Performance (hereinafter, COP) rating is used as a measure of efficiency. The COP is the actual output energy going into the load and powering it, divided by the energy that must be input into the device with its motor/load combination. If there were zero internal losses in a motor, that "perfect" motor would have a COP equal to 1.0. That is, all energy input into the motor would be output by the motor directly into the load, and none of the input energy would be lost or dissipated in the motor itself.

In magnetic motor generators presently in use, however, due to friction and design flaws, there are always internal losses and inefficiencies. Some of the energy input into the motor is dissipated in these internal losses. As a consequence, the energy that gets to the load is always less than the input energy. So a standard motor operates with a COP of less than 1.0, which is expressed as $COP<1.0$. An inefficient motor may have a $COP=0.4$ or 0.45, while a specially designed, highly efficient motor may have a $COP=0.85$.

The conservative field inside of a motor itself is divided into two phases. Producing a conservative field involves net symmetry between the "power out" phase from the magnetics to the rotor/flywheel and the "power back in" phase from the rotor/flywheel back to the magnetics. That is, the two flows of energy (one from the magnetics into the rotor and flywheel, and one from the rotor and flywheel back to the magnetics) are identical in magnitude but opposite in direction. Each phase alone is said to be "asymmetrical", that is, it either has: 1) a net energy flow out to the rotor/flywheel; or 2) a net energy flow back into the magnetics from the rotor/flywheel. In simplified terms, it is referred to as "power out" and "power back in" phases with respect to the motor magnetics.

For the power-out phase, energy is derived from the EMF existing between the stator pole and incoming rotor pole in an attraction mode. In this phase, the rotary motion (angular momentum and kinetic energy) of the rotor and flywheel is increased. In short, power is added to the rotor/flywheel (and thus to the load) from the fields between stator pole and rotor pole (the electromagnetic aspects of the system).

For the "power back in" phase, energy must be fed back into the magnetics from the rotor and flywheel (and the load) to overcome the drag forces existing between stator pole and outgoing rotor pole. In this phase, energy is returned back to the internal magnetic system from the rotary motion of the rotor and flywheel (the angular momentum, which is the rotational energy×time). As is well known in physics, a rotor/flywheel's angular momentum provides a convenient way to store energy with the spinning rotor/flywheel mass acting as an energy reservoir.

Most present day conventional magnetic motors use various methods for overcoming and partially reversing back EMF. Back EMF may be defined as the return pulse from the coil out of phase and is the result of regauging, which is the process of reversing the magnetics polarity, that is, form North to South, etc. The back EMF is shorted out and the rotor is attracted back in, therefore eliminating drag. This can be accomplished by pouring in more energy, which overpowers the back EMF, thereby producing a forward EMF in that region. The energy required for this method is furnished by the operator.

It is well known in the art that changing the voltage alone creates a back EMF and requires no work. This is because to change the potential energy does not require changing the form of that potential energy, but only its magnitude. Work is the changing of the form of energy. Therefore, as long as the form of the potential energy is not changed, the magnitude can be changed without having to perform work in the process. The motor of the present invention takes advantage of this permissible operation to create back EMF asymmetrically, and thereby change its own usable available potential energy.

In an electric power system, the potential (voltage) is changed by inputting energy to do work on the internal charges of the generator or battery. This potential energy is expended within the generator (or battery) to force the internal charges apart, forming a source dipole. Then the external closed circuit system connected to that source dipole ineptly pumps the spent electrons in the ground line back through the back EMF of the source dipole, thereby scattering the charges and killing the dipole. This shuts off the energy flow from the source dipole to the external circuit. As a consequence of this conventional method, it is a requirement to input and replace additional energy to again restore the dipole. The circuits currently utilized in most electrical generators have been designed to keep on destroying the energy flow by continually scattering all of the dipole charges and terminating the dipole. Therefore, it is necessary to keep on inputting energy to the generator to keep restoring its source dipole.

A search of prior art failed to reveal any monopole motor devices and methods that recycle available energy from back EMF to charge a battery or provide electrical energy for other uses as described in the present invention. However, the following prior art patents were reviewed:

U.S. Pat. No. 4,055,789 to Lasater, Battery Operated Motor with Back EMF Charging.

U.S. Pat. No. 2,279,690 to Z. T. Lindsey, Combination Motor Generator.

SUMMARY OF THE INVENTION

An aspect of the device and method of the present invention is a new monopole electromagnetic motor that captures back EMF energy. The captured back EMF energy maybe used to charge or store electrical energy in a recovery battery. The amount of energy recoverable, as expressed in watts, is dependent upon the configuration, circuitry, switching elements and the number and size of stators, rotors, magnets and coils that comprise the motor.

The motor uses a small amount of energy from a primary battery to "trigger" a larger input of available energy by supplying back EMF, thus increasing the potential energy of the system. The system then utilizes this available potential energy to reduce or reverse the back EMF, thereby increasing the efficiency of the motor and, therefore, the COP.

If the energy in phase 1 (the power-out phase) is increased by additional available energy in the electromagnetics themselves, then the energy in phase 1 can be made greater than the energy in phase 2 (the power-back-in phase) without the operator furnishing the energy utilized. This produces a non-conservative net field. Net power can then be taken from the rotating stator and flywheel, because the available energy added into the stator and flywheel by the additional effects is transformed by the rotor/flywheel into excess angular momentum and stored as such. Angular momentum is conserved at all times; but now some of the angular momentum added to the flywheel is evoked by additional effects in the electromagnetics rather than being furnished by the operator.

That is, the motor deliberately creates a back EMF itself and its potential energy once at a time, thereby retaining each extra force for a period of time and applying it to increase the angular momentum and kinetic energy of the rotor and flywheel. Specifically, this back EMF energy with its net force is deliberately applied in the motor of the present invention to overcome and even reverse the conventional drag-back (the back EMF). Hence less energy must be taken from the rotor and flywheel to overcome the reduced back EMF, and in the ideal case none is required since the back EMF has been overpowered and converted to forward EMF by the back EMF energy and force. In the motor, the conventional drag section of the magnetics becomes a forward-EMF section and now adds energy to the rotor/flywheel instead of subtracting it. The important feature is that the operator only pays for the small amount of energy necessary to trigger the back EMF from the primary battery, and does not have to furnish the much larger back EMF energy itself.

When the desired energy in phase 1 (the power out phase) is thus made greater than the undesired drag energy in phase 2, then part of the output power normally dragged from the rotor and flywheel by the fields in phase 2 is not required. Hence, additional power compared to the system (without the special back EMF mechanisms) is available from the rotor/flywheel. The rotor maintains additional angular momentum and kinetic energy, compared to a system, which does not produce back EMF itself. Consequently, the excess angular momentum retained by the rotor and flywheel can be utilized as additional shaft power to power an external load connected to the shaft.

In the motor, several known processes and methods are utilized which allow the motor to operate periodically as an open dissipative system (receiving available excess energy from back EMF) far from thermodynamic equilibrium, whereby. it produces and receives its excess energy from a known external source.

A method is utilized to temporarily produce a much larger source of available external energy around an energized coil. Design features of this new motor provide a device and method that can immediately produce a second increase in that energy concurrently as the energy flow is reversed. Therefore, the motor is capable of producing two asymmetrical back EMFs, one after the other, of the energy within a single coil, which dramatically increases the energy available and causes that available excess energy to then enter the circuit impulsively, being collected and utilized.

The motor utilizes this available excess back EMF energy to overcome and even reverse the drag EMF between stator pole and rotor pole, while furnishing only a small trigger pulse of energy from a primary battery necessary to control and activate the direction of the back EMF energy flow.

By using a number of such dual asymmetrical self back EMFs for every revolution of the rotor, the rotor and flywheel collectively focus all the excess impulsive inputs into increased angular momentum (expressed as energy× time), shaft torque, and shaft power.

Further, some of the excess energy deliberately generated in the coil by the utilization of the dual process manifests in the form of excess electrical energy in the circuit and can be utilized to charge a recovery battery(s). The excess energy can also be used to power electrical loads or to power the rotor and flywheel, with the rotor/flywheel also furnishing shaft horsepower for powering mechanical loads.

The motor utilizes a means to furnish the relatively small amount of energy from a primary battery to initiate the impulsive asymmetrical self back EMF actions. Then part of the available excess electrical power drawn off from back EMF created energy is utilized to charge a recovery battery with dramatically increased over-voltage pulses.

Design features of this monopole motor utilize one magnetic pole of each rotor and stator magnet. The number of impulsive self-back EMF in a single rotation of the rotor is doubled. Advanced designs can increase the number of self-back EMFs in a single rotor rotation with the result that there is an increase in the number of impulses per rotation, which increase the power output of this new motor.

The sharp voltage spike produced in the coil of this monopole motor by the rapidly collapsing field in the back EMF coil is connected to a recovery battery(s) in charge mode and to an external electrical load. The net result is that the coil asymmetrically creates back EMF itself in a manner adding available energy and impulse to the circuit. The available energy collected in the coil is used to reverse the back-EMF phase of the stator-rotor fields to a forward EMF condition, impulsively adding acceleration and angular momentum to the rotor and flywheel. The available back EMF energy collected in the coil is used to charge a battery. Loads can then be drawn off the battery.

A device and method in which the monopole motor alters the reaction cross section of the coils in the circuit, which momentarily changes the reaction cross section of the coil in which it is invoked. Thus, by this new motor using only a small amount of current in the form of a triggering pulse, it is able to evoke and control the immediate change of the coil's reaction cross section to this normally wasted energy-flow component. As a result, the motor captures and directs some of this usually wasted available environmental energy, collecting the available excess energy in the coil and then releasing it for use in the motor. By timing and switching, the innovative gate design in this new motor directs the available excess energy so that it overcomes and reverses the return EMF of the rotor-stator pole combination during what would normally be the back EMF and demonstrates the creation of the second back EMF of the system. Now instead of an "equal retardation" force being produced in the back EMF region, a forward EMF is produced that is additive to the rotor/flywheel energy and not subtractive. In short, it further accelerates the rotor/flywheel.

This results in a non-conservative magnetic field along the rotor's path. The line integral of the field around that path (i.e., the net work on the rotor/flywheel to increase its energy and angular momentum) is not zero but a significant amount. Hence, the creation of an asymmetrical back EMF impulse magnetic motor: 1) takes its available excess energy from a known external source, the huge usually non-intercepted portion of the energy flow around the coil; 2) further increases the source dipolarity by this back EMF energy; and 3) produces available excess energy flow directly from the source dipole's increased broken symmetry in its fierce energy exchange with the local vacuum.

By operating as an open dissipative system not in thermodynamic equilibrium with the active vacuum, the system can permissibly receive available energy from a known environmental source and then output this energy to a load. As an open dissipative system not in thermodynamic equilibrium, this new and unique monopole motor can tap in on back EMF to energize itself, loads and losses simultaneously, fully complying with known laws of physics and thermodynamics.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective side view of a monopole back EMF motor with a single stator and a single rotor.

FIG. 2 is a perspective top view of a monopole back EMF motor with a single stator and a single rotor.

FIG. 3 is a block diagram demonstrating the circuitry for a monopole back EMF motor.

DETAILED DESCRIPTION OF THE INVENTION

An embodiment of the present invention is a device and method for a monopole back EMF electromagnetic motor. As described in the Summary of the Invention, this monopole motor conforms to all applicable electrodynamic laws of physics and is in harmony with the law of the conservation of energy, the laws of electromagnetism and other related natural laws of physics.

The monopole back EMF electromagnetic motor comprises a combination of elements and circuitry to capture available energy (back EMF) in a recovery element, such as a capacitor, from output coils. The available stored energy in the recovery element is used to charge a recovery battery.

As a starting point and an arbitrary method in describing this device, the flow of electrical energy and mechanical forces will be tracked from the energy's inception at the primary battery to its final storage in the recovery battery.

FIG. 1 is a perspective side view of the monopole motor according to an embodiment of the invention. As shown in FIG. **1**, electrical energy from primary battery **11** periodically flows through power switch **12** and on to and through power-coil wiring **13***a*. In one embodiment, power switch **12** is merely an On-Off mechanical switch and is not electronic. However, the switch **12** may be a solid-state switching circuit, a magnetic Reed switch, a commutator, an optical switch, a Hall switch, or any other conventional transistorized or mechanical switch. Coil **13** is comprised of three windings: power-coil winding **13***a*, trigger-coil winding **13***b*, and recovery-coil winding **13***c*. However, the number of windings can be more or fewer than three, depending upon the size of the coil **13**, size of the motor and the amount of available energy to be captured, stored and used, as measured in watts. Electrical energy then periodically flows from power-coil winding **13***a* and through transistor **14**. Trigger energy also periodically flows through variable potentiometer **15** and resistor **16**. Clamping diode **17** clamps the reverse base-emitter voltage of transistor switch **14** at a safe reverse-bias level that does not damage the transistor **14**. Energy flows to stator **18***a* and pole piece **18***b*, an extension of stator **18***a*. Pole piece **18***b* is electrically magnetized only when transistor switch **14** is on and maintains the same polarity as the rotor poles **19**—here North pole—when electrically magnetized. The North rotor poles **19***a*, **19***b* and **19***c*, which are attached to rotor **20**, come in momentary apposition with pole piece **18***b* creating a momentary monopole interface. The poles **19***a,b,c*, which are actually permanent magnets with their North poles facing outward from the rotor **20**, maintain the same polarity when in momentary apposition with pole piece **18***b*. Rotor **20** is attached to rotor shaft **21**, which has drive pulley **22**. Attached to rotor shaft **21** are rotor-shaft bearing blocks **31***a* and **31***b*, as seen in FIG. **2**. As rotor **20** begins to rotate, the poles **19***a,b,c* respectively comes in apposition with magnetized pole piece **18***b* in a momentary monopole interface with energy flowing through diode bridge rectifier **23** and capacitor **24**. The number of capacitors may be of a wide range, depending upon the amount of energy to be temporarily stored before being expelled or flash charged into recovery battery **29**. Timing belt **25** connects drive pulley **22** on timing shaft **21** to timing wheel **26**. Attached to timing wheel **26** is contact rotor **27**, a copper insulated switch that upon rotation, comes in contact with brushes on mechanical switch **28**. The means for counting the number of rotor revolutions may be a timing gear or a timing belt. Finally, the available energy derived from the back EMF that is stored in capacitor **24** is then discharged and stored in recovery battery **29**.

FIG. **2** is a mechanical perspective top view of the monopole motor of the instant invention without electrical circuitry. Stator **18***a* consists of coil **13**, which is comprised of three separate coil windings: power-coil winding **13***a*, trigger-coil winding **13***b* and recovery-coil winding **13***c*. Pole piece **18***b* is at the end of stator **18***a*. As rotor **20**, which is attached to rotor shaft **21**, rotates, each pole **19** respectively comes in a momentary monopole interface with pole piece **18***b*. The polarity of pole piece **18***b* is constant when electrically magnetized. Rotor shaft **21** has rotor shaft bearing blocks **31***a,b* attached to it for stabilization of rotor shaft **21**. Attached to rotor shaft **21** is drive pulley **22** with timing belt **25** engaged onto it. Another means for timing may be a timing gear. Timing belt **25** engages timing wheel **26** at its other end. Timing wheel **26** is attached to timing shaft **30**. Shaft **30** is stabilized with timing shaft bearing blocks **32***a,b*. At one end of timing shaft **30** is contact rotor **27** with brush **28***a*, which, upon rotation of timing shaft **26**, comes into momentary contact with brushes **28***b,c*.

FIG. **3** is a block diagram detailing the circuitry of the monopole motor. Block **40** represents primary battery **11** with energy flowing to coil block **41**, which represents coil windings **13***a,b,c*. From coil block **41** energy flows into three directions: to trigger-circuit block **42**, transistor-circuit block **43**, and rectifier-circuit block **44**. Energy flows from rectifier-block **44** to storage-capacitor block **45** with energy flowing from block **45** to both recovery-battery block **46** and rotor-switch block **47**.

Referring to FIG. **1**, the operation of the motor is described according to an embodiment of the invention. For purpose of explanation, assume that the rotor **20** is initially not moving, and one of the poles **19** is in the three o'clock position.

First, one closes the switch **12**. But because the transistor **14** is off, no current flows through the winding **13***a*.

Next, one starts the motor by rotating the rotor **20**, for example in a clockwise rotation. One may rotate the rotor by hand, or with a conventional motor-starting device or circuit (not shown).

As the rotor **20** rotates, the pole **19** rotates from the three o'clock position toward the pole piece **18***b* and generates a magnetic flux in the windings **13***a*–**13***c*. More specifically, the stator **18***a* and the pole piece **18***b* include a ferromagnetic material such as iron. Therefore, as the pole **19** rotates nearer to the pole piece **18***b*, it magnetizes the pole piece **18***b* to a polarity—here South—that is opposite to the polarity of the pole **19**—here North. This magnetization of the pole piece **18***b* generates a magnetic flux in the windings **13***a*–**13***c*. Furthermore, this magnetization also causes a magnetic attraction between the pole **19** and the pole piece **18***b*. This attraction pulls the pole **19** toward the pole piece **18***b*, and thus reinforces the rotation of the rotor **20**.

The magnetic flux in the windings **13***a*–**13***c* generates respective voltages across the windings. More specifically, as the pole **19** rotates toward the pole piece **18***b*, the magnetization of the stator **18***a* and the pole piece **18***b*, and thus the flux in the windings **13***a*–**13***c*, increase. This increasing flux generates respective voltages across the windings **13***a*–**13***c* such that the dotted (top) end of each winding is more positive than the opposite end. These voltages are proportional to the rate at which the flux is increasing, and thus are proportional to the velocity of the pole **19**.

At some point, the voltage across the winding **13***b* becomes high enough to turn on the transistor **14***c*. This turn-on, i.e., trigger, voltage depends on the combined serial resistance of the potentiometer **15** and the resistor **16**. The higher this combined resistance, the higher the trigger voltage, and vice-versa. Therefore, one can set the level of the trigger voltage by adjusting the potentiometer **15**.

In addition, depending on the level of voltage across the capacitor **24**, the voltage across the winding **13***c* may be high enough to cause an energy recovery current to flow through the winding **13***c*, the rectifier **23**, and the capacitor **24**. Thus, when the recovery current flows, the winding **13***c* is converting magnetic energy from the rotating pole **19** into electrical energy, which is stored in the capacitor **24**.

Once turned on, the transistor **14** generates an opposing magnetic flux in the windings **13***a*–**13***c*. More specifically, the transistor **14** draws a current from the battery **11**, through the switch **12** and the winding **13***b*. This current increases and generates an increasing magnetic flux that opposes the flux generated by the rotating pole **19**.

When the opposing magnetic flux exceeds the flux generated by the rotating pole **19**, the opposing flux reinforces the rotation of the rotor **20**. Specifically, when the opposing flux—which is generated by the increasing current through the winding **13***a*—exceeds the flux generated by the pole **19**, the magnetization of the pole piece **18** inverts to North pole. Therefore, the reverse-magnetic pole piece **18** repels the pole **19**, and thus imparts a rotating force to the rotor **20**. The pole piece **18** rotates the rotor **20** with maximum efficiency if the pole-piece magnetization inverts to North when the center of the pole **19** is aligned with the center of the pole piece. One typically adjusts the potentiometer **15** to set the trigger voltage of the transistor **14** at a level that attains or approximates this maximum efficiency.

The transistor **14** then turns off before the opposing flux can work against the rotation of the rotor **20**. Specifically, if the pole piece **18** remains magnetized to North pole, it will repel the next pole **19** in a direction—counterclockwise in this example—opposite to the rotational direction of the rotor **20**. Therefore, the motor turns the transistor **14**, and thus demagnetizes the pole piece **18**, before this undesirable repulsion occurs. More specifically, when the opposing flux exceeds the flux generated by the pole **19**, the voltage across the winding **13***b* reverses polarity such that the dotted end is less positive than the opposite end. The voltage across the winding **13***b* decreases as the opposing flux increases. At some point, the voltage at the base of the transistor decreases to a level that turns off the transistor **14**. This turn-off point depends on the combined resistance of the potentiometer **15** and resistor **16** and the capacitance (not shown) at the transistor base. Therefore, one can adjust the potentiometer **15** or use other conventional techniques to adjust the timing of this turn-off point.

The rectifier **23** and capacitor **24** recapture the energy that is released by the magnetic field—and that would otherwise be lost—when the transistor **14** turns off. Specifically, turning off the transistor **14** abruptly cuts off the current that flows through the winding **13***a*. This generates voltage spikes across the windings **13***a*–**13***c* where the dotted ends are less positive than the respective opposite ends. These voltage spikes represent the energy released as the current-induced magnetization of the stator **18***a* and the pole piece **18***b* collapses, and may have a magnitude of several hundred volts. But as the voltage spike across the winding **13***c* increases above the sum of the two diode drops of the rectifier **23**, it causes an energy-recovery current to flow through the rectifier **23** and the voltage across the capacitor **24** charge the capacitor **24**. Thus, a significant portion of the energy released upon collapse of the current-induced magnetic field is recaptured and stored as a voltage in the capacitor **24**. In addition, the diode **17** prevents damage to the transistor **14** by clamping the reverse base-emitter voltage caused by the voltage spike across the winding **13***b*.

The recaptured energy can be used in a number of ways. For example, the energy can be used to charge a battery **29**. In one embodiment, the timing wheel **26** makes two revolutions for each revolution of the rotor **20**. The contact rotor **27** closes a switch **28**, and thus dumps the charge on the capacitor **24** into the battery **29**, once each revolution of the wheel **26**. Other energy-recapture devices and techniques can be used as well.

One can stop the rotor **20** by braking it or by opening the switch **12**.

Other embodiments of the monopole motor are contemplated. For example, instead of remaining closed for the entire operation of the motor, the switch **12** may be a conventional optical switch or a Hall switch that opens and closes automatically at the appropriate times. To increase the power of the motor, one can increase the number of stators **18***a* and pole pieces **18***b*, the number of poles **19**, or both. Furthermore, one can magnetize the stator **18***a* and pole piece **18***b* during the attraction of the pole **19** instead of or in addition to magnetizing the stator and pole piece during the repulsion of the pole **19**. Moreover, the stator **18***a* may be omitted such that the coil **13** has an air coil, or the stator **18***a* and the pole piece **18***b* may compose a permanent magnet. In addition, although the transistor **14** is described as being a bipolar transistor, it may be a MOS transistor. Furthermore, the recaptured energy may be used to recharge the battery **11**. In addition, although described as rotating in a clockwise direction, the rotor **20** can rotate in a counter-clockwise direction. Moreover, although described as attracting a rotor pole **19** when no current flows through winding **13***a* and repelling the pole **19** when a current flows through winding **13***a*, the pole piece **18***b* may be constructed so that it attracts the pole **19** when a current flows through winding **13***a* and repels the pole **19** when no current flows through winding **13***a*.

In multiple stator/rotor systems, each individual stator may be energized one at a time or all of the stators may be energized simultaneously. Any number of stators and rotors may be incorporated into the design of such multiple stator/rotor monopole motor combinations. However, while there may be several stators per rotor, there can only be one rotor for a single stator. The number of stators and rotors that would comprise a particular motor is dependent upon the amount of power required in the form of watts. Any number of magnets, used in a monopole fashion, may comprise a single rotor. The number of magnets incorporated into a particular rotor is dependent upon the size of the rotor and power required of the motor. The desired size and horse power of the motor determines whether the stators will be in parallel or fired sequentially. Energy is made accessible through the capturing of available energy from the back EMF as a result of the unique circuitry and timing of the monopole motor. Individual motors may be connected in sequence with each motor having various combinations of stators and rotors or in parallel. Each rotor may have any number of rotor magnets, all arranged without change of polarity. The number of stators for an individual motor may also be of a wide range.

One feature that distinguishes this motor from all others in the art is the use of monopole magnets in momentary apposition with the pole piece of the stator maintaining the same polarity when magnetized. In this particular embodiment, there are three magnets and one pole piece, said pole piece an extension of a permanent-magnet stator. Finally, although the invention has been described with reference of particular means, materials and embodiments, it is to be understood that the invention is not limited to the particulars disclosed and extends to all equivalents within the scope of the claims.

What is claimed is:

1. A back EMF monopole motor utilizing a rotor wherein the magnets of said rotor maintain a polarity when in apposition with a stator pole piece having the polarity, said motor to capture available back EMF energy for charging and storage in a recovery device, the motor comprising:

a. a means for producing initial energy;

b. a means for capturing energy in the form of back EMF, said back EMF energy available as the result of a collapsing field in a coil, said coil comprised of multiple windings with said pole piece at one end of said stator of said coil, said pole piece having said polarity when magnetized and in apposition to said magnets of said rotor;

c. a means for rectifying said back EMF energy, said means comprising a voltage bridge for transferring said energy to a capacitor for storage;

d. a means for discharging said stored voltage across a recovery battery; and

e. a means for counting the revolutions on said rotor.

2. The back EMF monopole motor of claim **1**, wherein the means for producing the initial energy comprises a battery.

3. The back EMF monopole motor of claim **1**, wherein said means for counting the revolutions on said rotor comprises a timing gear.

4. The back EMF monopole motor of claim **1**, wherein said means for counting the revolutions on said rotor comprises a timing belt.

5. The back EMF monopole motor of claim **1**, wherein said means for discharging collected energy comprises a rotating switching commutator, said commutator switch discharging said energy into a recovery battery, said commutator switch having the same polarity as said recovery battery.

6. A back EMF monopole motor utilizing a rotor wherein the magnets of said rotor maintain a polarity when in apposition with a magnetized stator pole piece having the polarity, said motor to capture available back EMF energy for charging and storage in a recovery device, the motor comprising:

a. a means for producing initial energy, said means a primary input battery and a means for switching the battery, said means for switching either a solid-state switching circuitry, a magnetic Reed switch, a commutator, an optical switch, or a Hall switch;

b. a means for capturing energy in the form of back EMF, said back EMF energy available as the result of a collapsing field in a coil, said coil comprised of multiple windings, and said pole piece at one end of said stator of said coil, said pole piece maintaining said polarity when magnetized and in apposition to said magnets of said rotor;

c. a means for rectifying said back EMF energy, said means comprising a voltage bridge for transferring said energy to a capacitor for storage;

d. a means for discharging said stored voltage across a recovery battery, said means a rotating contact rotor switch;

e. a means for counting the revolutions on said rotor, said means a timing gear or timing belt;

f. a means for switching said rotating contact rotor switch, said means comprising a rotating switching commutator.

7. A back EMF monopole motor utilizing a rotor wherein the magnets of said rotor maintain a polarity when in apposition with a stator pole piece magnetized to have the polarity, said motor to capture available back EMF energy for charging and storage in a recovery device such as a battery, the motor comprising:

a. an initial energy input produced by a device such as a battery;

b. said back EMF energy captured and available as the result of a collapsing field in a coil, said coil comprised of multiple windings with said pole piece having the polarity when magnetized and in apposition to said magnets of said rotor;

c. said back EMF energy transferred by said rotor containing said magnets, which maintain the polarity and in momentary apposition with said magnetized stator pole piece having said polarity;

d. said back EMF energy rectified using a voltage bridge transferring said energy to a capacitor for storage;

e. said voltage discharged across a recovery device such as a battery for storage by means of a rotating contact rotor switch;

f. a timing belt or timing gear used to count the revolutions on said rotor; and

g. a rotating switching commutator to control said rotating contact rotor switch.

8. A method of producing a back EMF monopole motor utilizing a rotor wherein magnets of said rotor retain a polarity when in apposition with a pole piece of a stator, said motor to capture available back EMF energy for charging and storage in a recovery battery, comprising the steps of:

a. producing initial energy;

b. switching a voltage to drive a motor;

c. capturing said energy in the form of back EMF, said back EMF energy available as the result of a collapsing field in a coil, said coil comprised of multiple windings and said pole piece at one end of said stator of said coil, said pole piece maintaining the polarity when magnetized and in apposition to said magnets of said rotor;

d. recovering said back EMF energy in a storage device.

9. The method of claim **8**, wherein the back EMF energy is rectified by using a bridge transferring said energy to a capacitor for storage.

10. The method of claim **8**, wherein voltage is discharged across a recovery battery using a rotating contact rotor switch, said switch having the same polarity as said recovery battery.

* * * * *

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Bedini

(10) **Patent No.:** **US 6,677,730 B2**
(45) **Date of Patent:** **Jan. 13, 2004**

(54) **DEVICE AND METHOD FOR PULSE CHARGING A BATTERY AND FOR DRIVING OTHER DEVICES WITH A PULSE**

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(73) Assignee: **Energenx, Inc.**, Coeur d'Alene, ID (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 46 days.

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(52) **U.S. Cl.** **320/139**
(58) **Field of Search** 320/103, 124, 320/125, 129, 130, 139, 166

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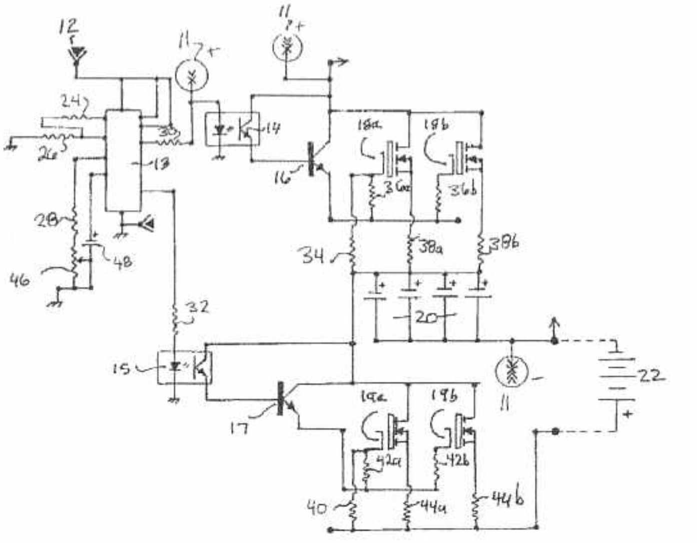
(57) **ABSTRACT**

A two-phase solid-state battery charger can receive input energy from a variety of sources including AC current, a battery, a DC generator, a DC-to-DC inverter, solar cells or any other compatible source of input energy. Phase I is the charge phase and phase II the discharge phase wherein a signal or current passes through a dual timing switch that controls independently two channels dividing the two phases. The dual timing switch is controlled by a logic chip or pulse width modulator. A potential charge is allowed to build up in a capacitor bank, the capacitor bank is then disconnected from the energy input source and then pulse charged at high voltage into the battery to receive the charge. The momentary disconnection of the capacitor from the input energy source allows for a free-floating potential charge in the capacitor. Once the capacitor has completed discharging the potential charge into the battery, the capacitor disconnects from the battery and re-connects to the energy source thus completing the two-phase cycle.

25 Claims, 6 Drawing Sheets



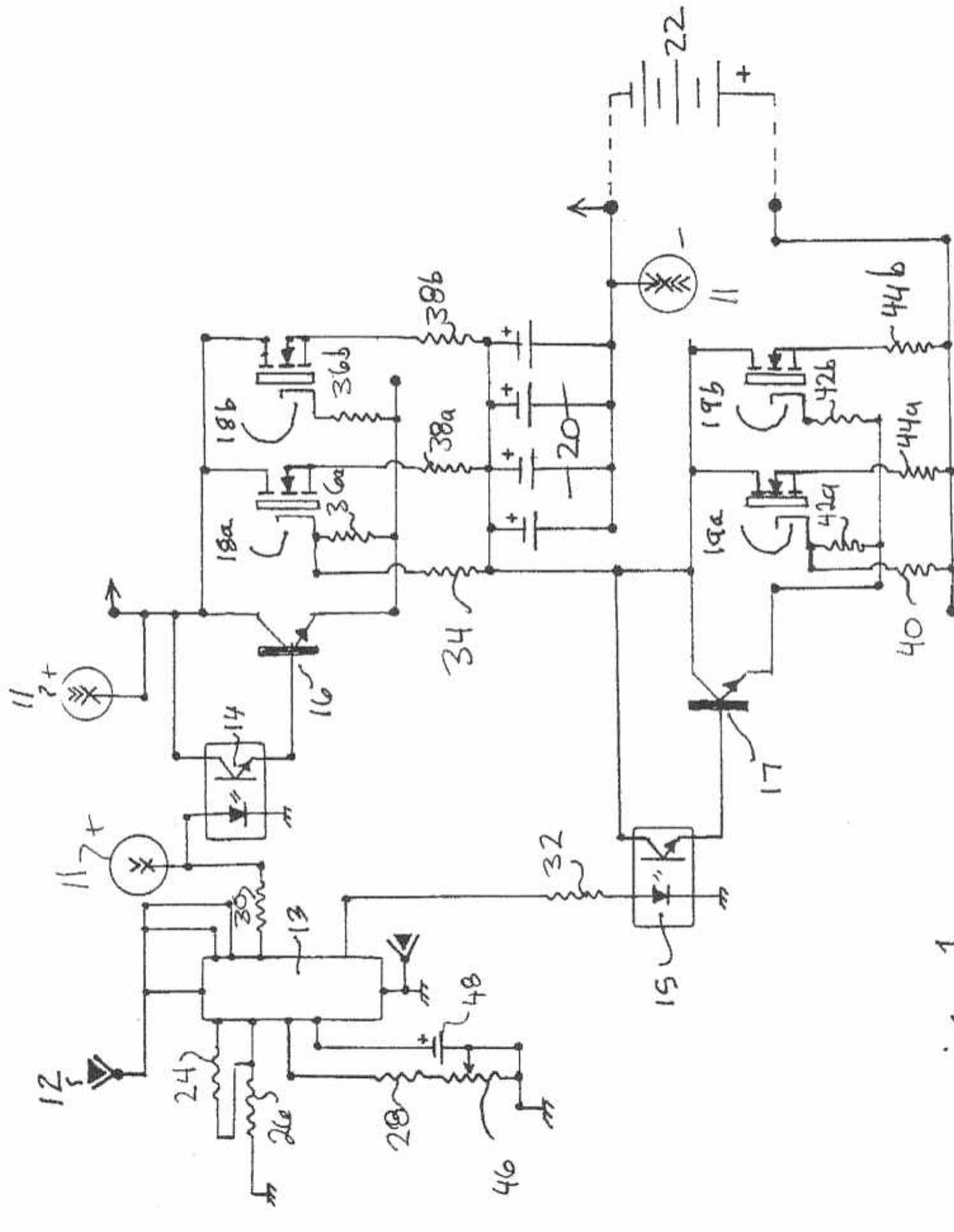


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FIG. 1

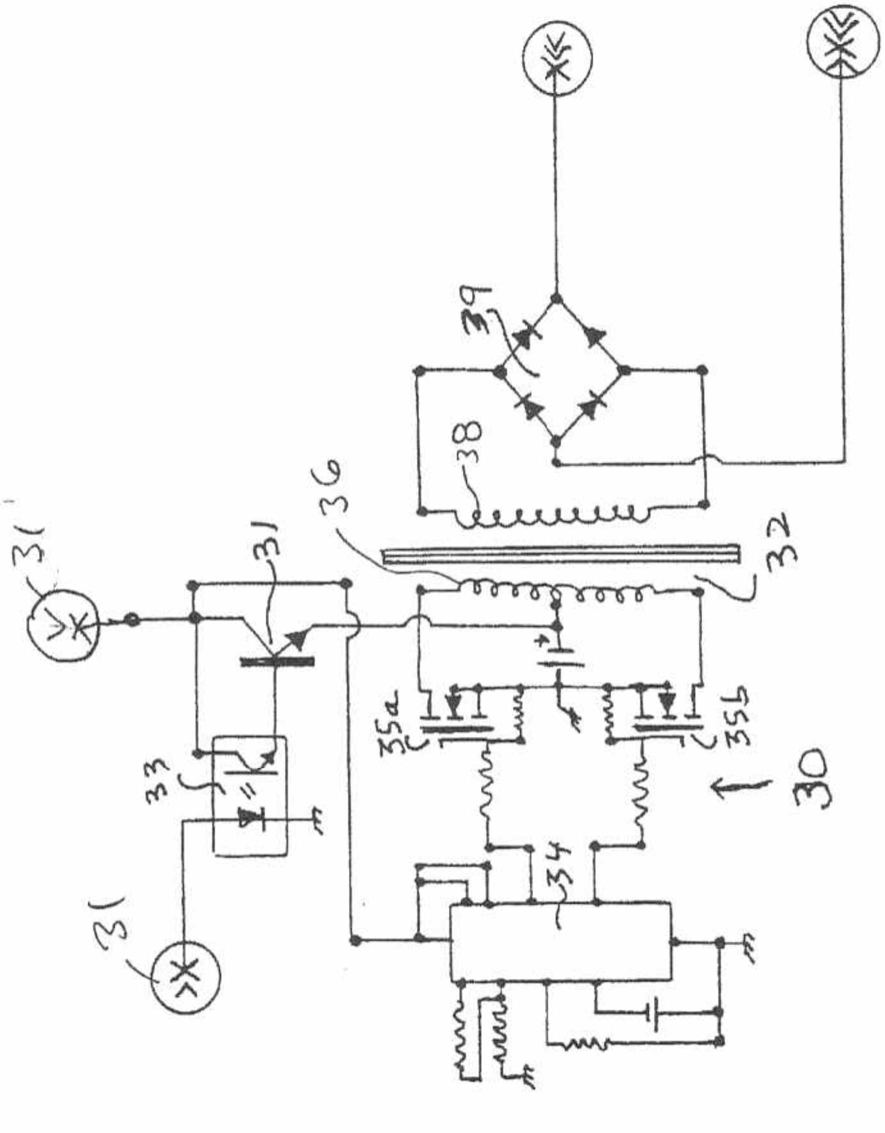

FIG. 2

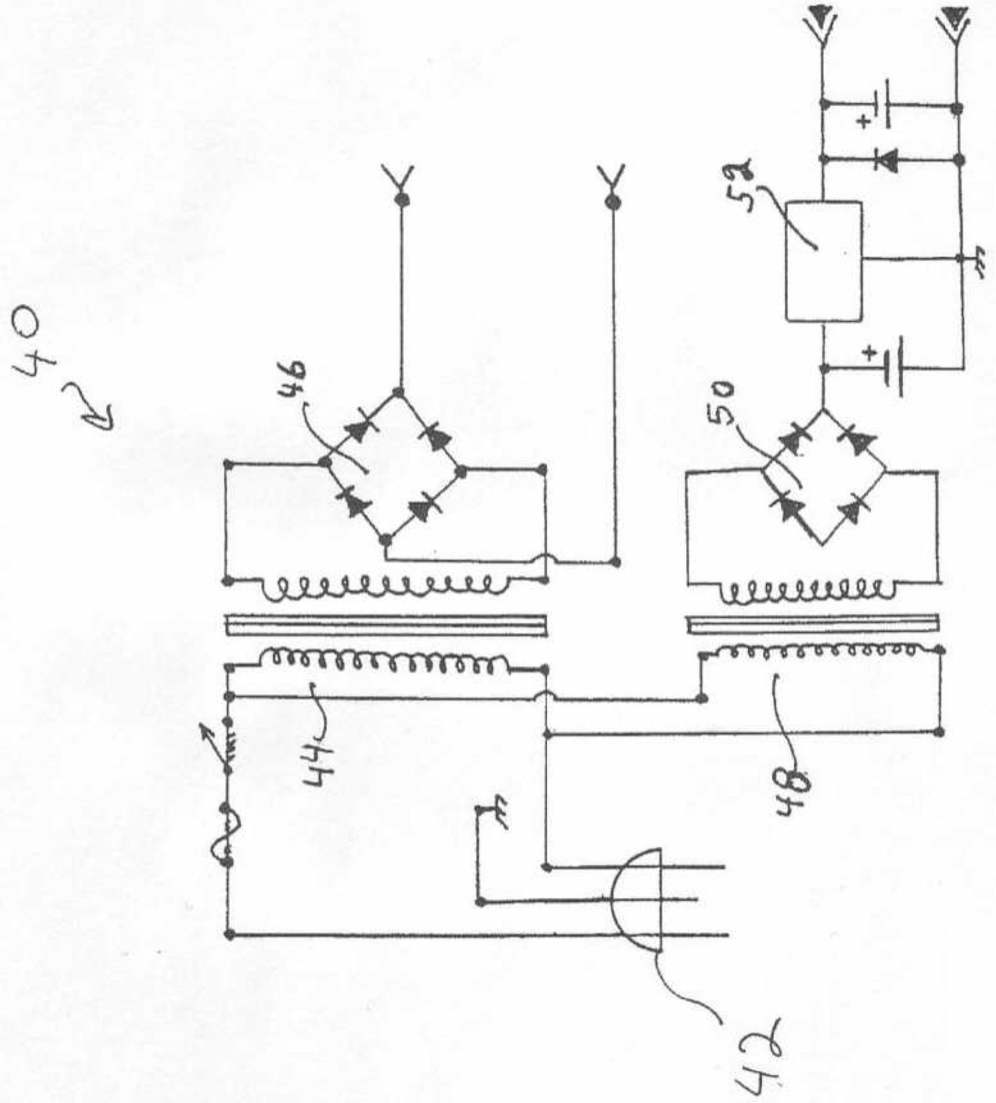

FIG. 3

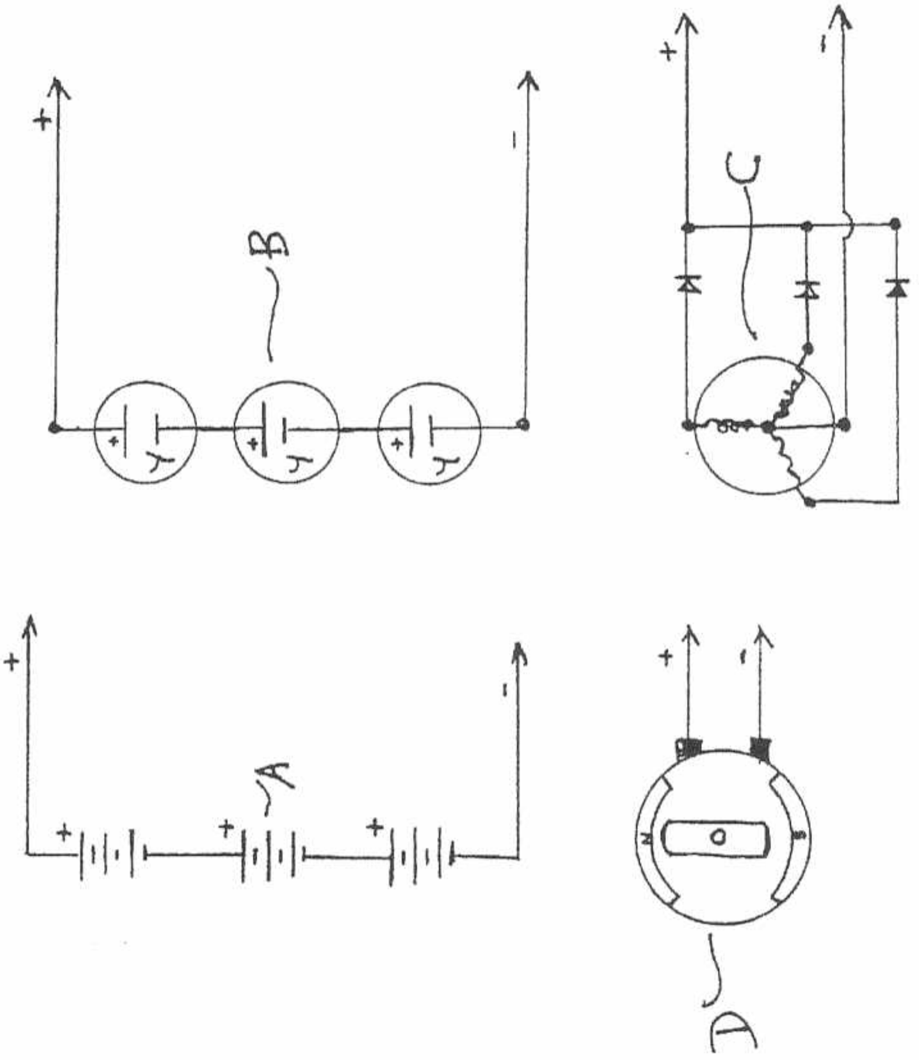

FIG. 4A-D

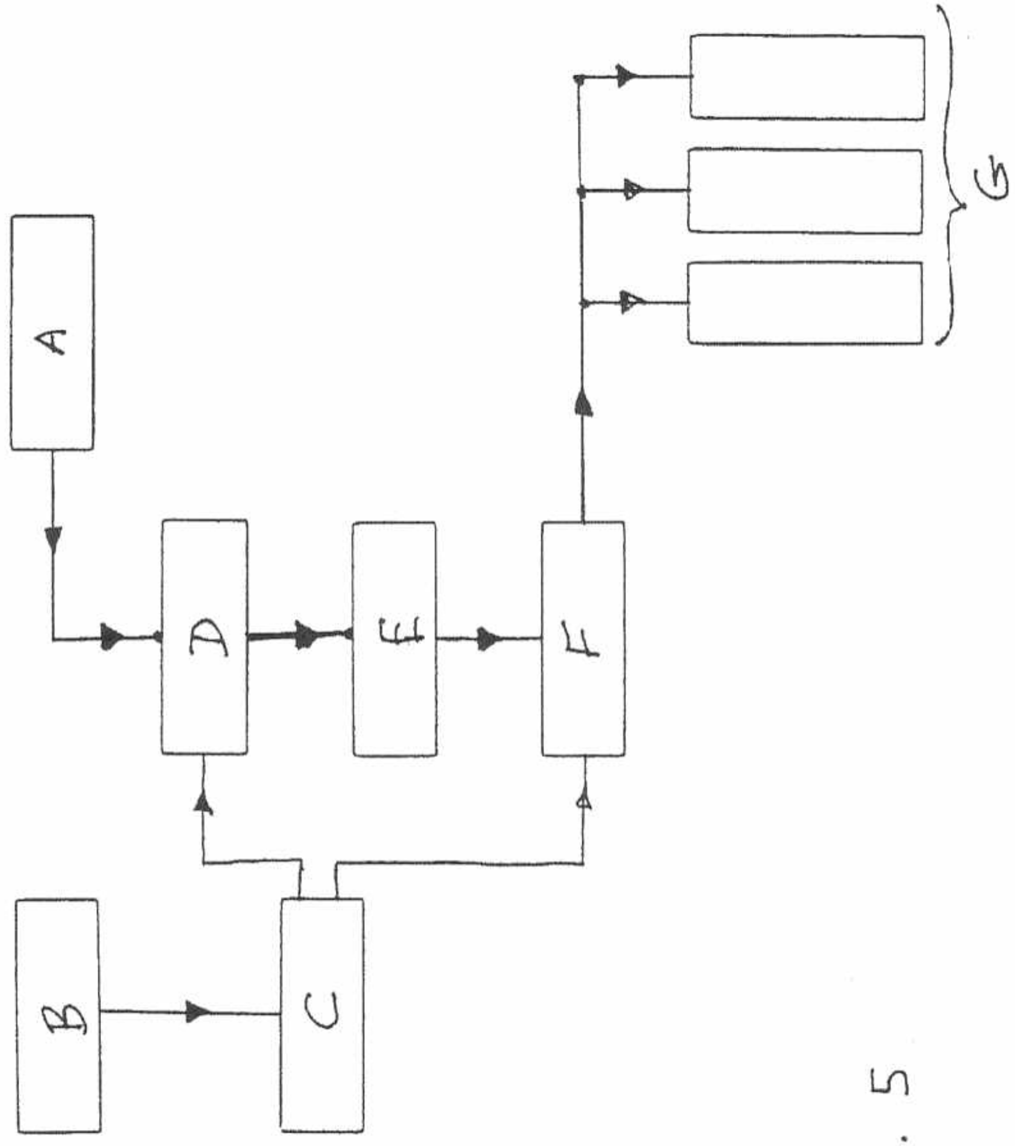

FIG. 5

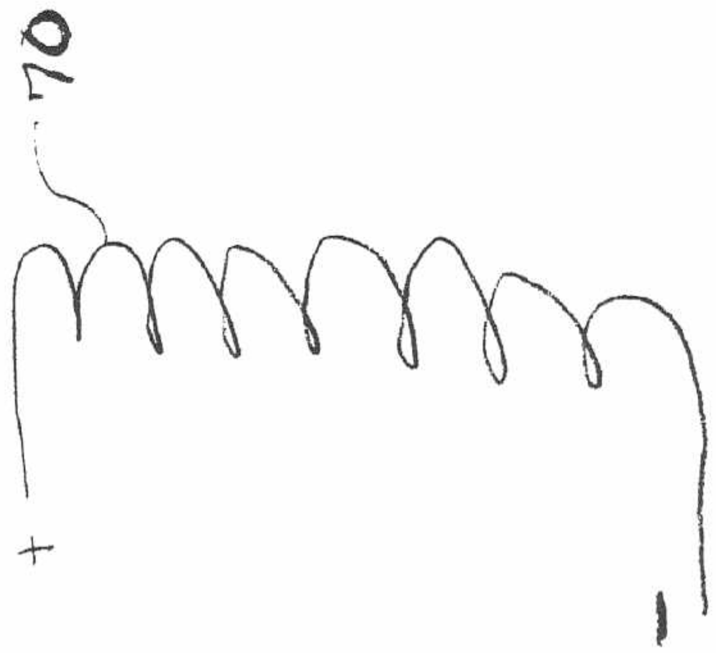

FIG. 7

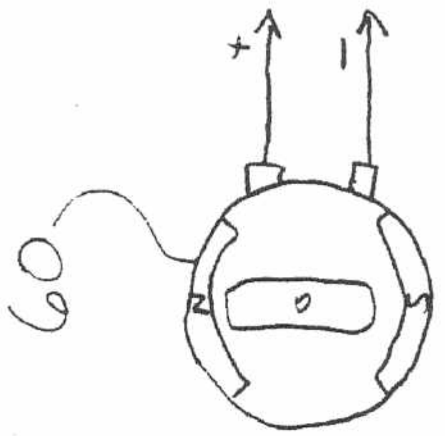

FIG. 6

DEVICE AND METHOD FOR PULSE CHARGING A BATTERY AND FOR DRIVING OTHER DEVICES WITH A PULSE

TECHNICAL FIELD

The invention relates generally to a battery pulse charger using a solid-state device and method wherein the current going to the battery is not constant. The signal or current is momentarily switch-interrupted as it flows through either the first channel, the charge phase, or the second channel, the discharge phase. This two-phase cycle alternates the signal in the two channels thereby allowing a potential charge in a capacitor to disconnect from its power source an instant before the capacitor discharges its stored potential energy into a battery for receiving the capacitor's stored energy. The capacitor then disconnects from the battery and re-connects to the power source upon completion of the discharge phase, thereby completing charge-discharge cycle. The battery pulse charger can also drive devices, such as a motor and a heating element, with pulses.

BACKGROUND AND PRIOR ART

Present day battery chargers use a constant charge current in their operation with no momentary disconnection of the signal or current as it flows either: 1) from a primary energy source to the charger; or 2) from the charger itself into a battery for receiving the charge. Some chargers are regulated to a constant current by any of several methods, while others are constant and are not regulated. There are no battery chargers currently in the art or available wherein there is a momentary signal or current disconnection between the primary energy source and the charger capacitors an instant before the capacitors discharge the stored potential energy into a battery receiving the pulse charge. Nor are there any chargers in the art that disconnect the charger from the battery receiving the charge when the charger capacitors receive energy from the primary source. The momentary current interruption allows the battery a short "rest period" and requires less energy from the primary energy source while putting more energy into the battery receiving the charge while requiring a shorter period of time.

SUMMARY OF THE INVENTION

One aspect of the invention relates to a solid-state device and method for creating a pulse current to pulse charge a battery or a bank of batteries in which a new and unique method is used to increase and preserve for a longer period of time the energy stored in the battery as compared to constant-current battery chargers. The device uses a timed pulse to create a waveform in a DC pulse to be discharged into the battery receiving the charge.

One embodiment of the Invention uses a means for dual switching such as a pulse width modulator (PWM), for example, a logic chip SG3524N PWM, and a means for optical coupling to a bank of high-energy capacitors to store a timed initial pulse charge. This is the charge phase, or phase I. The charged capacitor bank then discharges the stored high energy into the battery receiving the charge in timed pulses. Just prior to discharging the stored energy into the battery, the capacitor bank is momentarily disconnected from the power source, thus completing the charge phase, and thereby leaving the capacitor bank as a free-floating potential charge disconnected from the primary energy source to then be discharged into the battery. The transfer of energy from the capacitor bank to the battery completes the discharge phase, or phase II. The two-phase cycle now repeats itself.

This embodiment of the battery pulse charger works by transferring energy from a source, such as an AC source, to an unfiltered DC source of high voltage to be stored in a capacitor or a capacitor bank. A switching regulator is set to a timed pulse, for example, a one second pulse that is 180 degrees out of phase for each set of switching functions. The first function is to build the charge in the capacitor bank from the primary energy source; the second function is to disconnect the power source from the capacitor bank; the third function is to discharge the stored high voltage to the battery with a high voltage spike in a timed pulse, for example, a one second pulse; and the fourth function is to re-connect the capacitor bank to the primary energy source. The device operates through a two-channel on/off switching mechanism or a gauging/re-gauging function wherein the charger is disconnected from its primary energy source an instant before the pulse charger discharges the high-energy pulse into the battery to be charged. As the primary charging switch closes, the secondary discharging switch opens, and visa-versa in timed pulses to complete the two phase cycle.

The means for a power supply is varied with several options available as the primary energy source. For example, primary input energy may come from an AC source connected into the proper voltage (transformer); from an AC generator; from a primary input battery; from solar cells; from a DC-to-DC inverter; or from any other adaptable source of energy. If a transformer means is the source of primary input energy, it can be a standard rectifying transformer used in power supply applications or any other transformer means applicable to the desired function. For example, it can be a 120-volt to 45-volt AC step-down transformer, and the rectifier can be a full-wave bridge of 200 volts at 20 amps, which is unfiltered when connected to the output of the transformer. The positive output terminal of the bridge rectifier is connected to the drains of the parallel field-effect transistors, and the negative terminal is connected to the capacitor bank negative.

The Field Effect Transistor (FET) switches can be IRF260 FETs, or any other FET means to accomplish this function. All are in parallel to achieve the proper current of the pulses. Each FET may be connected through a 7-watt, 0.05-ohm resistor with a common bus connection at the source. All the FET gates may be connected through a 240-ohm resistor to a common bus. There also may be a 2 K-ohm resistor between the gates and the drain bus.

A transistor means, for example an MJE15024 transistor, as a driver for the gates, drives the bus and in turn, an optical coupler drives the driver transistor through the first channel. A first charging switch is used to charge the capacitor bank, which acts as a DC potential source to the battery. The capacitor bank is then disconnected from the power rectifier circuit. The pulse battery charger is then transferred to a second field effect switch through the second channel for the discharge phase. The discharge phase is driven by a transistor, the transistor driven by an optical coupler. With a second or discharge switch on, the capacitor bank potential charge is discharged into the battery to receive the charge. The battery receiving the charge is then disconnected from the pulse charger capacitor bank to repeat the cycle. The pulse charger may have any suitable source of input power including: 1) solar panels to raise the voltage to the capacitor bank; 2) a wind generator; 3) a DC-to-DC inverter; 4) an alternator; 5) an AC motor generator; 6) a static source such as a high voltage spark; and 7) other devices that can raise the potential of the capacitor bank.

In another embodiment of the invention, one can use the pulse charger to drive a device such as a motor or heating element with pulses of energy.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic drawing of a solid-state pulse charger according to an embodiment of the invention.

FIG. **2** is a schematic drawing of a conventional DC-to-DC converter that can be used to provide power to the pulse charger of FIG. **1** according to an embodiment of the invention.

FIG. **3** is a schematic drawing of a conventional AC power supply that can be used to provide power to the pulse charger of FIG. **1** according to an embodiment of the invention.

FIGS. **4A–D** are schematic drawings of other conventional power supplies that can be used to provide power to the pulse charger of FIG. **1** according to an embodiment of the invention.

FIG. **5** is a block diagram of the solid-state pulse charger of FIG. **1** according to an embodiment of the invention.

FIG. **6** is a diagram of a DC motor that the pulse charger of FIG. **1** can drive according to an embodiment of the invention.

FIG. **7** is a diagram of a heating element that the pulse charger of FIG. **1** can drive according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

An embodiment of the present invention is a device and method for a solid-state pulse charger that uses a stored potential charge in a capacitor bank. The solid-state pulse charger comprises a combination of elements and circuitry to capture and store available energy into a capacitor bank. The stored energy in the capacitors is then pulse charged into the battery to be charged. In one version of this embodiment, there is a first momentary disconnection between the charger and the battery receiving the charge during the charge phase of the cycle, and a second momentary disconnection between the charger and the input energy source during the discharge phase of the cycle.

As a starting point and an arbitrary method in describing this device and method, the flow of an electrical signal or current will be tracked from the primary input energy to final storage in the battery receiving the pulse charge.

FIG. **1** is a schematic drawing of the solid-state pulse charger according to an embodiment of the invention. As shown in FIG. **1**, the primary input energy source to the pulse charger is a power supply **11**, examples of which are shown in FIGS. **2**, **3**, **4A–4D**. A 12-volt battery, as a low voltage energy source **12**, drives a dual switching means of control such as a logic chip or a pulse width modulator (PWM) **13**. Alternatively, the voltage from the power supply **11** may be converted to a voltage suitable to power the PWM **13**. The PWM **13** may be an SG3524N logic chip, and functions as an oscillator or timer to drive a 2-channel output with "on/off" switches that are connected when on to either a first optical isolator **14**, or in the alternative, to a second optical isolator **15**. The first and second optical isolators **14** and **15** may be H11D3 optical isolators. When the logic chip **13** is connected to a first channel, it is disconnected from a second channel, thus resulting in two phases of signal direction; phase I, a charge phase, and phase II, a discharge phase. When the logic chip **13** is switched to the charge phase, the signal flows to the first optical isolator **14**. From the optical isolator **14**, the signal continues its flow through a first NPN power transistor **16** that activates an N-channel MOSFET **18***a* and an N-channel MOSFET **18***b*. Current flowing through the MOSFETs **18***a* and **18***b* builds up a voltage across a capacitor bank **20**, thereby completing the charge phase of the switching activity. The discharge phase begins when the logic chip **13** is switched to the second channel, with current flowing to the second optical isolator **15** and then through a second NPN power transistor **17**, which activates an N-channel MOSFET **19***a* and an N-channel MOSFET **19***b*. After the logic chip **13** closes the first channel and opens the second channel, the potential charge in the capacitor bank **20** is free floating between the power supply **11**, from which the capacitor bank **20** is now disconnected, and then connected to a battery **22** to receive the charge. It is at this point in time that the potential charge in the capacitor bank **20** is discharged through a high-energy pulse into the battery **22** or, a bank (not shown) of batteries. The discharge phase is completed once the battery **22** receives the charge. The logic chip **13** then switches the second channel closed and opens the first channel thus completing the charge-discharge cycle. The cycle is repetitive with the logic chip **13** controlling the signal direction into either channel one to the capacitor bank, or to channel two to the battery **22** from the capacitor bank. The battery **22** is given a momentary rest period without a continuous current during the charge phase.

The component values for the described embodiment are as follows. The resistors **24**, **26**, . . . **44***b* have the following respective values: 4.7KΩ, 4.7KΩ, 47KΩ, 330Ω, 330Ω, 2KΩ, 47Ω, 47Ω, 0.05Ω(7 W), 0.05Ω(7W), 2KΩ, 47Ω, 47Ω, 0.05Ω(7 W), and 0.05Ω(7W). The potentiometer **46** is 10KΩ, the capacitor **48** is 22 μF, and the total capacitance of the capacitor bank **20** is 0.132F. The voltage of the battery **22** is between 12–24 V, and the voltage of the power supply **11** is 24–50 V such that the supply voltage is approximately 12–15 V higher than the battery voltage.

Other embodiments of the pulse charger are contemplated. For example, the bipolar transistors **16** and **17** may be replaced with field-effect transistors, and the transistors **18***a*, **18***b*, **19***a*, and **19***b* may be replaced with bipolar or insulated-gate bipolar (IGBT) transistors. Furthermore, one can change the component values to change the cycle time, the peak pulse voltage, the amount of charge that the capacitor bank **20** delivers to the battery **22**, etc. In addition, the pulse charger can have one or more than two transistors **18***a* and **18***b*, and one or more than two transistors **19***a* and **19***b*.

Still referring to FIG. **1**, the operation of the above-discussed embodiment of the pulse charger is discussed.

To begin the first phase of the cycle during which the capacitor bank **20** is charged, the logic circuit **13** deactivates the isolator **15** and activates the isolator **14**. Typically, the circuit **13** is configured to deactivate the isolator **15** before or at the same time that it activates the isolator **14**, although the circuit **13** may be configured to deactivate the isolator **15** after it activates the isolator **14**.

Next, the activated isolator **14** generates a base current that activates the transistor **16**, which in turn generates a current that activates the transistors **18***a* and **18***b*.

The activated transistors **18***a* and **18***b* charge the capacitors in the bank **20** to a charge voltage equal or approximately equal to the voltage of the power supply **11** less the lowest threshold voltage of the transistors **18***a* and **18***b*. To begin the second phase of the cycle during which the capacitor bank **20** pulse charges the battery **22**, the logic circuit **13** deactivates the isolator **14** and activates the isolator **15**. Typically, the circuit **13** is configured to deactivate the isolator **14** before or at the same time that it activates the isolator **15**, although the circuit **13** may be configured to deactivate the isolator **14** after it activates the isolator **15**.

Next, the activated isolator **15** generates a base current that activates the transistor **17**, which in turn generates a current that activates the transistors **19***a* and **19***b*.

The activated transistors **19***a* and **19***b* discharge the capacitors in the bank **20** into the battery **22** until the voltage across the bank **20** is or is approximately equal to the voltage across the battery **22** plus the lowest threshold voltage of the transistors **19***a* and **19***b*. Alternatively, the circuit **13** can deactivate the isolator **15** at a time before the bank **20** reaches this level of discharge. Because the resistances of the transistors **19***a* and **19***b*, the resistors **44***a* and **44***b*, and the battery **22** are relatively low, the capacitors in the bank **20** discharge rather rapidly, thus delivering a pulse of current to charge the battery **22**. For example, where the pulse charger includes components having the values listed above, the bank **20** delivers a pulse of current having a duration of or approximately of 100 ms and a peak of or approximately of 250 A.

FIG. **2** is a schematic drawing of a conventional DC-to-DC converter **30** that can be used as the power supply **11** of FIG. **1** according to an embodiment of the invention. A DC-to-DC converter converts a low DC voltage to a higher DC voltage or vice-versa. Therefore, such a converter can convert a low voltage into a higher voltage that the pulse charger of FIG. **1** can use to charge the capacitor bank **20** (FIG. **1**). More specifically, the converter **30** receives energy from a source **31** such as a 12-volt battery. An optical isolator sensor **33** controls an NPN power transistor **31**, which provides a current to a primary coil **36** of a power transformer **32**. A logic chip or pulse width modulator (PWM) **34** alternately switches on and off an IRF260 first N-channel MOSFET **35***a* and an IRF260 second N-channel MOFSET **35***b* such that when the MOSFET **35***a* is on the MOSFET **35***b* is off and vice-versa. Consequently, the switching MOSFETS **35***a* and **35***b* drive respective sections of the primary coil **36** to generate an output voltage across a secondary coil **38**. A full-wave bridge rectifier **39** rectifies the voltage across the secondary coil **38**, and this rectified voltage is provided to the pulse charger of FIG. **1**. Furthermore, the secondary coil **38** can be tapped to provide a lower voltage for the PWM **13** of FIG. **1** such that the DC-to-DC converter **30** can be used as both the power supply 11 and the low-voltage supply **12** of FIG. **1**.

FIG. **3** is a schematic drawing of an AC power supply **40** that can be used as both the power supply **11** and the power supply **12** of FIG. **1** according to an embodiment of the invention. The power input **42** to the supply **40** is 120 VAC. A first transformer **44** and full-wave rectifier **46** compose the supply 11, and a second transformer **48**, full-wave rectifier **50**, and voltage regulator **52** compose the supply **12**.

FIGS. **4A–D** are schematic drawings of various conventional primary energy input sources that can be used as the supply 11 and/or the supply **12** of FIG. **1** according to an embodiment of the invention. FIG. **4A** is a schematic drawing of serially coupled batteries; FIG. **4B** is a schematic drawing of serially coupled solar cells; FIG. **4C** is a schematic drawing of an AC generator; and FIG. **4D** is a schematic drawing of a DC generator.

FIG. **5** is a block diagram of the solid-state pulse charger of FIG. **1** according to an embodiment of the invention. Block A is the power supply **11**, which can be any suitable power supply such as those shown in FIGS. **2**, **3**, **4A–4D**. Block B is the power supply **12**, which can be any suitable power supply such as a 12 VDC supply or the supply shown in FIG. **3**. Block C is the PWM **13** and its peripheral components. Block D is the charge switch that includes the first optical isolator chip **14**, the first NPN power transistor **16**, the first set of two N-channel MOSFETs **18***a* and **18***b*, and their peripheral resistors. Block E is the capacitor bank **20**. Block F is the discharge switch that includes the second optical isolator chip **15**, the second NPN power transistor **17**, the second set of two N-channel MOSFETs **19***a* and **19***b*, and their peripheral resistors. Block G is the battery **22** that is being pulse charged.

A unique feature that distinguishes one embodiment of the above-described pulse charger from conventional chargers is the method charging the battery with pulses of current instead of with a continuous current. Consequently, the battery is given a reset period between pulses.

FIG. **6** is a diagram of a DC motor **60** that the pulse charger of FIG. **1** can drive according to an embodiment of the invention. Specifically, one can connect the motor **60** in place of the battery **22** (FIG. **1**) such that the pulse charger drives the motor with pulses of current. Although one need not modify the pulse charger to drive the motor **60**, one can modify the pulse charger to make it more efficient for driving the motor. For example, one can modify the values of the resistors peripheral to the PWM **13** (FIG. **1**) to vary the width and peak of the drive pulses from the capacitor bank **20** (FIG. **1**).

FIG. **7** is a diagram of a heating element **70**, such as a dryer- or water-heating element, that the pulse charger of FIG. **1** can drive according to an embodiment of the invention. Specifically, one can connect the heating element **70** in place of the battery **22** (FIG. **1**) such that the pulse charger drives the element with pulses of current. Although one need not modify the pulse charger to drive the element **70**, one can modify the pulse charger to make it more efficient for driving the element. For example, one can modify the values of the resistors peripheral to the PWM **13** (FIG. **1**) to vary the width and peak of the drive pulses from the capacitor bank **20** (FIG. **1**).

In the embodiments discussed above, specific electronic elements and components are used. However, it is known that a variety of available transistors, resistors, capacitors, transformers, timing components, optical isolators, pulse width modulators, MOSFETs, and other electronic components may be used in a variety of combinations to achieve an equivalent result. Finally, although the invention has been described with reference of particular means, materials and embodiments, it is to be understood that the invention is not limited to the particulars disclosed and extends to all equivalents within the scope of the claims.

What is claimed is:

1. A solid-state pulse battery charger wherein input power from a primary source is stored as a potential charge in a capacitor bank, said capacitor bank then disconnected from said input power source through a dual timing means, said capacitor then connected to a battery to receive the potential charge, the charge then discharged into said battery from said capacitor, said battery then disconnected from said capacitor through said dual timing means, said capacitor then re-connected to said input power source completing a two phase switching cycle comprising:

- a. a means for providing input power;
- b. a means for timing a signal and a current flow in two phases, a charge phase and a discharge phase, through either a first channel output for charging said capacitor bank, or a second channel output for discharging stored energy from said capacitor into said battery, the current flowing from said first channel output through a first optical isolator and through a first NPN power transistor, said first transistor activating a first pair of N-channel MOSFETs with voltage stored as the potential charge in said capacitor bank, said capacitor disconnecting from said input power means by said timing means;
- c. said means for timing current flow connecting to said second channel output, current flowing from said second channel through a second optical isolator and through a second NPN power transistor, said second transistor activating a second pair of N-channel MOSFETs, said capacitor connecting to said battery, the potential charge discharging into said battery, said timing means disconnecting said capacitor from said battery, and connecting said capacitor to said power means.

2. The pulse charger of claim **1** wherein the means for providing input power is an AC voltage current.

3. The pulse charger of claim **1** wherein the means for providing input power is a battery.

4. The pulse charger of claim **1** wherein the means for providing input power is a DC generator.

5. The pulse charger of claim **1** wherein the means for providing input power is an AC generator.

6. The pulse charger of claim **1** wherein the means for providing input power is a solar cell.

7. The pulse charger of claim **1** wherein the means for providing input power is a DC-to-DC inverter.

8. A method of making a solid-state pulse battery charger wherein input power from a primary source is stored as a potential charge in a capacitor bank, said capacitor disconnected from said input power source through a dual timing means, said capacitor connected to a battery to receive the potential charge, said charge discharged into said battery from said capacitor, said battery disconnected from said capacitor through said dual timing means, said capacitor reconnected to said input power source completing a two phase cycle comprising the steps of:

- a. providing a source of input power;
- b. connecting a means for dual-timing said charger to control a signal or current flow through a first channel output comprising a first optical isolator, a first NPN power transistor and a first pair of N-channel MOSFETs;
- c. capturing energy from said current and storing said energy in said capacitor bank thereby charging said capacitor;
- d. switching the flow of said current using said timing device to a second channel comprising a second optical isolator, a second NPN power transistor and a second pair of N-channel MOSFETs, thus disconnecting said capacitor from said power source and connecting said capacitor to said battery;
- e. discharging the potential charge into said battery;
- f. switching the flow of the current using said timing device to said power source and said first channel to complete said cycle.

9. The pulse charger of claim **8** wherein the means for providing input power is an AC voltage current.

10. The pulse charger of claim **8** wherein the means for providing input power is a battery.

11. The pulse charger of claim **8** wherein the means for providing input power is a DC generator.

12. The pulse charger of claim **8** wherein the means for providing input power is an AC generator.

13. The pulse charger of claim **8** wherein the means for providing input power is a solar cell.

14. The pulse charger of claim **8** wherein the means for providing input power is a DC-to-DC inverter.

15. A battery charger, comprising:

a supply node;

a charge node;

a charge-storage device; and

a switch circuit coupled to the supply and the charge nodes and the charge-storage device, the switch circuit operable to,

  charge the charge-storage device and prohibit a battery-charge current from flowing into the charge node during a battery-rest period; and

  allow the battery-charge current to flow from the charge-storage device into the charge node during a battery-charge period, and

prohibit the battery-charge current from flowing into the charge node during a battery-rest period.

16. The battery charger of claim **15**, further comprising:

a capacitor coupled to the switch circuit; and

wherein the switch circuit is operable to,

  allow the battery-charge current to from the capacitor into the charge node during the battery-charge period, and

charge the capacitor during the battery-rest period.

17. A method, comprising:

charging a battery during a first period of a charge cycle; and

accumulating charge in a charge-storage device and prohibiting the charging of the battery during a second period of the charge cycle.

18. The method of claim **17** wherein:

charging the battery comprises charging the battery with a charge current during the first period of the charge cycle; and

prohibiting the charging of the battery comprises prohibiting the charge current from flowing into the battery during the second period of the charge cycle.

19. The method of claim **17**, wherein:

charging the battery comprises discharging the charge-storage device into the battery during the first period of the charge cycle; and

prohibiting the charging of the battery comprises uncoupling the charge-storage device from the battery during the second period of the charge cycle.

20. The method of claim **17** wherein the charge-storage device comprises a capacitor.

21. The method of claim **17** wherein the length of the second period is related to a level of charge accumulated in the charge-storage device.

22. A method, comprising:

discharging a charge-storage device into a battery during a first period of a battery-charge cycle; and

uncoupling the charge-storage device from the battery and charging the charge-storage device during a second period of the battery-charge cycle.

23. The method of claim **22** wherein uncoupling the charge-storage device comprises uncoupling the charge-storage device from the battery before commencing charging of the charge-storage device.

24. The method of claim **22** wherein uncoupling the charge-storage uncoupling the charge-storage device from the battery after commencing charging of the charge-storage device.

25. The method of claim **22** wherein uncoupling the charge-storage device comprises simultaneously uncoupling the charge-storage device from the battery and commencing charging of the charge-storage device.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,677,730 B2
DATED : January 13, 2004
INVENTOR(S) : John C. Bedini

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 10,
Line 2, before "uncoupling", please insert -- device comprises --.

Signed and Sealed this

Sixth Day of July, 2004

Jon W. Dudas

JON W. DUDAS
Acting Director of the United States Patent and Trademark Office

US007990110B2

(12) **United States Patent**
Bedini

(10) **Patent No.: US 7,990,110 B2**
(45) **Date of Patent: Aug. 2, 2011**

(54) CIRCUITS AND RELATED METHODS FOR CHARGING A BATTERY

(76) Inventor: **John C. Bedini**, Coeur d'Alene, ID (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 400 days.

(21) Appl. No.: **11/592,633**

(22) Filed: **Nov. 3, 2006**

(65) **Prior Publication Data**

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(51) **Int. Cl.**
H02J 7/00 (2006.01)
H02J 7/04 (2006.01)
H02J 7/06 (2006.01)

(52) **U.S. Cl.** **320/139**; 320/137; 320/163; 320/128

(58) **Field of Classification Search** 320/139, 320/140, 141, 145, 165, 128; 363/15, 21.06, 363/18

See application file for complete search history.

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Primary Examiner — Edward Tso
Assistant Examiner — Ahmed Omar
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(57) ABSTRACT

An aspect of the present invention provides a circuit for generating a voltage that can be used to recharge a battery. The circuit includes an inductive voltage generator operable to generate a magnetic field when the voltage generator is energized by power, and operable to generate a voltage from the magnetic field's collapse when the voltage generator is de-energized, and a switch operable to allow the voltage generator to receive power to energize the voltage generator, and operable to disconnect the power from the voltage generator to de-energize the generator. With this circuit, a power source that generates less voltage than the fully charged capacity of a rechargeable battery can be used to recharge the battery. Also, the circuit can convert power in different forms, such as constant direct current, varying direct current, or alternating current, into a second voltage for charging a battery. Furthermore, the circuit can supply whatever charging voltage is most suitable for the specific battery that is being charged. Current is delivered to the battery in the form of high energy impulses which can improve the proper removal or deposit of material from/on an electrode of the battery. Consequently the life of the battery being charged by the circuitry employed by the present invention is significantly extended, and, in many cases, a battery that is unable to be charged by traditional means, can be restored to a useable condition.

48 Claims, 3 Drawing Sheets

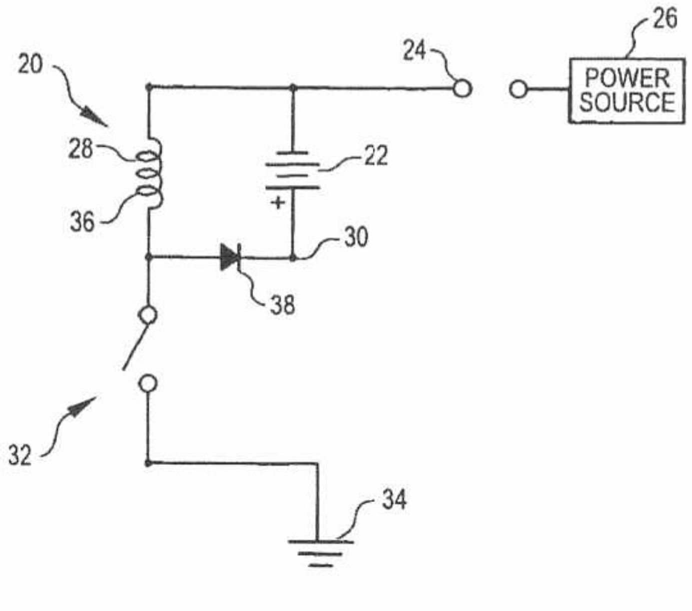


FIG. 1

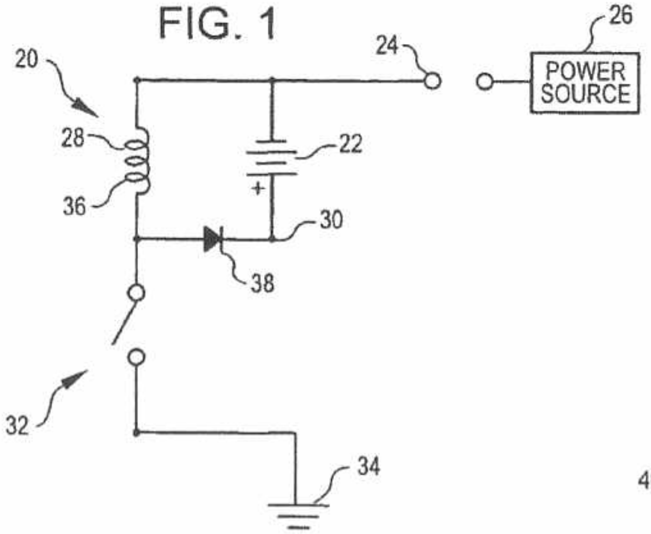


FIG. 2

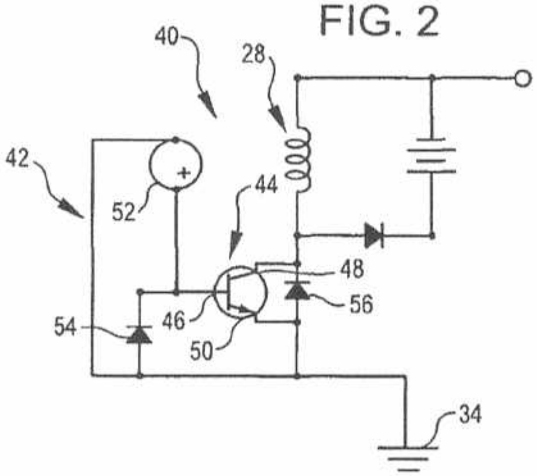


FIG. 3

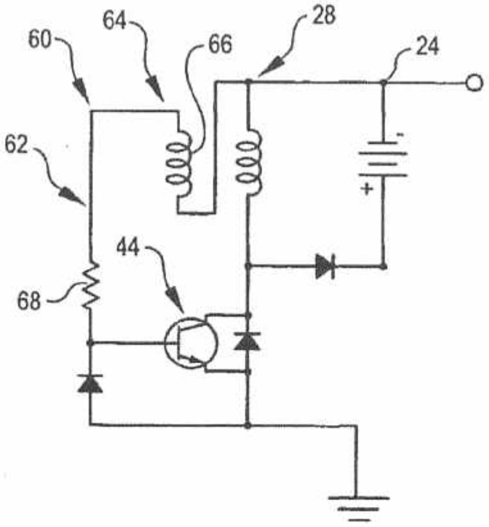


FIG. 4

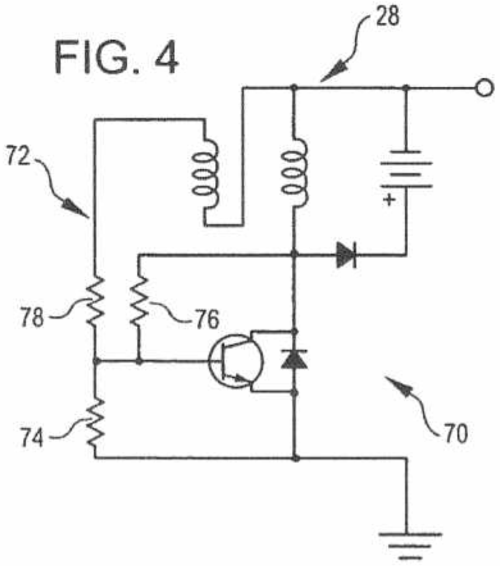


FIG. 5

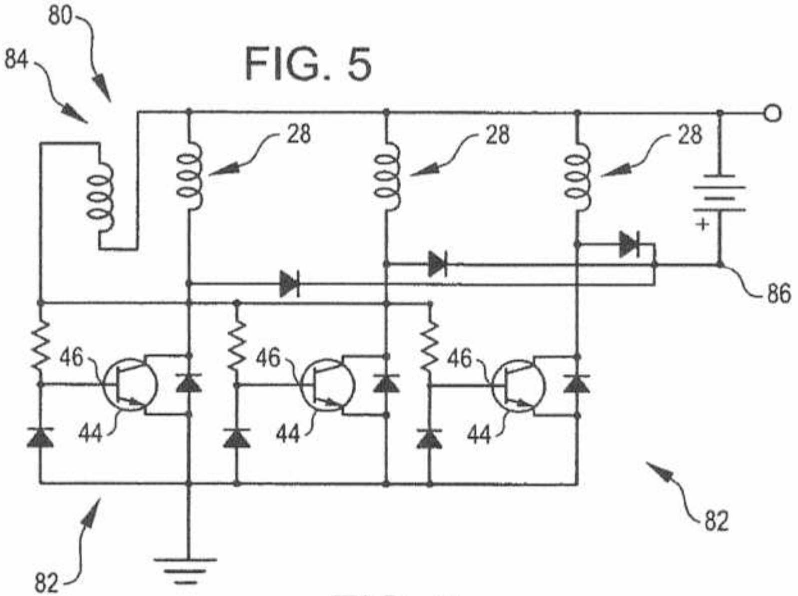


FIG. 6

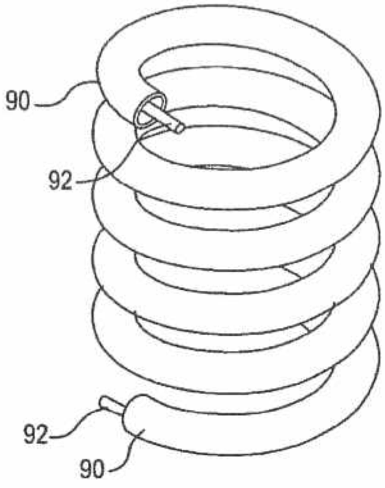


FIG. 7

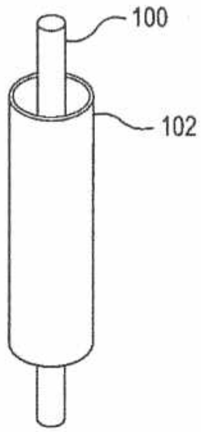


FIG. 8

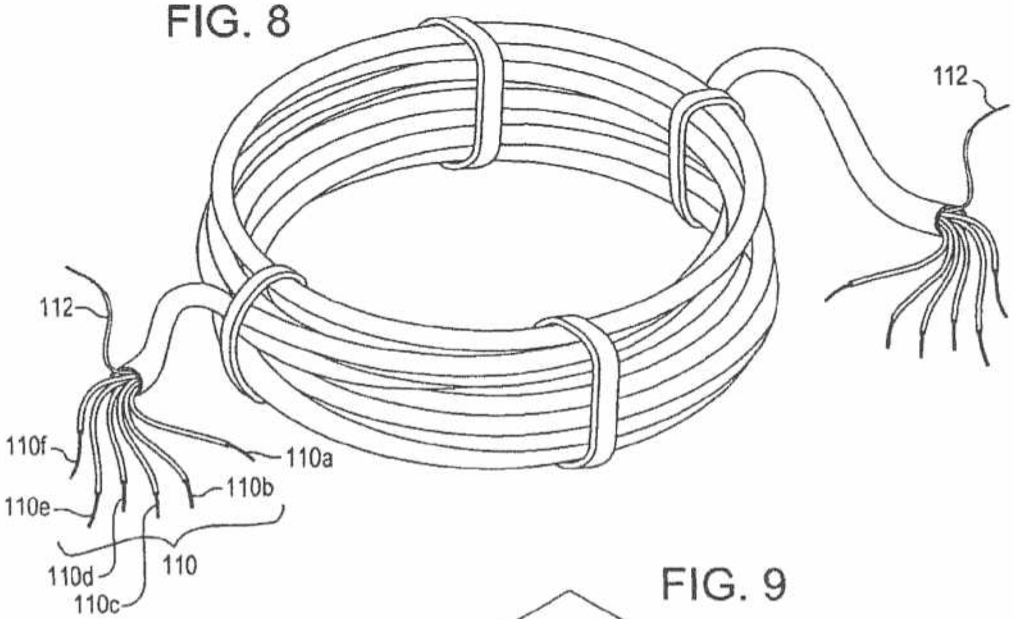


FIG. 9

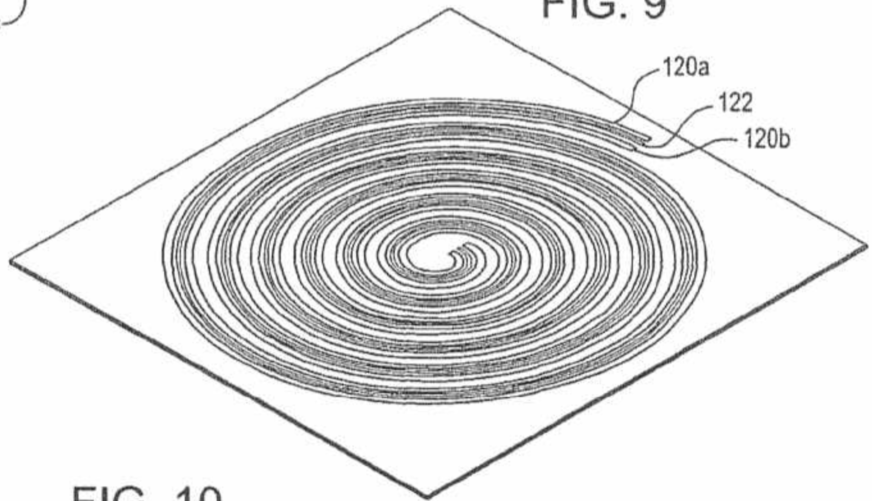


FIG. 10

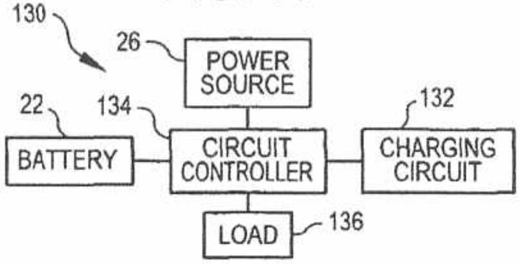
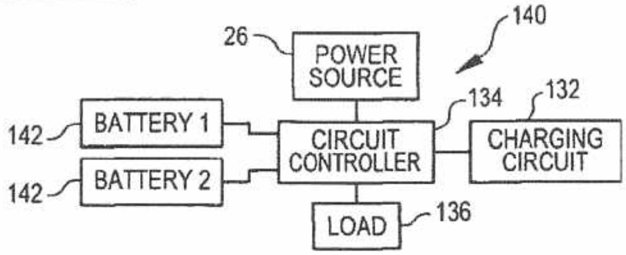


FIG. 11



CIRCUITS AND RELATED METHODS FOR CHARGING A BATTERY

BACKGROUND

Many types of batteries, such as lead-acid, nickel-cadmium, and lithium-ion, can be recharged to replenish their charge and thus be used again to power a device such as an MP3 player, an electric motor for a golf cart, or a starter motor for an internal combustion engine. An advantage to using a rechargeable battery to power a device is that one does not have to purchase many single-use batteries to power the device.

The process for recharging a battery involves applying a current to the battery that is opposite in polarity to the discharge current generated by the battery. The applied current reverses the battery's chemical process that occurs in the discharge cycle, and causes material to be deposited on and/or removed from one or more of the battery's electrodes. Some recharge processes provide the depleted battery a constant current at a voltage that is slightly higher than the standing voltage of the battery when it is fully charged. A problem with this process is that the current does not decrease as the battery nears its full charge capacity. Thus, the battery receives more current than the chemical process can consume when the battery nears it charge capacity. The excess current can damage the battery by:

1) Converting a portion of its electrolyte into gas which is vented from the battery,

2) Improperly removing material from or depositing material to an electrode of the battery, or

3) Excessively heating the battery.

Another recharge process provides the depleted battery a current at a constant voltage that is slightly higher than the fully recharged capacity of the battery. Thus, as the depleted battery is recharged, the voltage difference between the charging source and the battery decreases, causing the current delivered to the battery to decrease. One problem with this process is that it takes significantly longer for the depleted battery to reach its full charge capacity at the end of the recharge cycle. Another problem is that the battery can suffer the same damaging effects of the constant current recharge process during the beginning of a constant voltage recharge cycle because there is an excessive current caused by an initially high difference in voltage between the charging source and the battery at the beginning of the recharge cycle.

A problem common to both the constant current and constant voltage charging methods is the inability of the battery to completely reverse all of the battery chemistry to the original condition it had before it was discharged. In other words, with each discharge/recharge cycle there exists a portion of the battery's chemistry that is not converted back to the charged condition. This results in successive degradation of the battery with each discharge/recharge cycle until the battery's capacity is lowered beyond a state of practical use and must be replaced.

SUMMARY

An aspect of the present invention provides a circuit for generating a voltage that can be used to recharge a battery. The circuit includes a supply node operable to receive electrical power having a first voltage, a voltage generator operable to generate a magnetic field when the voltage generator is energized by electrical power, and operable to generate a second voltage from the magnetic field's collapse when the voltage generator is de-energized, an output node operable to provide access to the second voltage, and a switch operable to allow the voltage generator to receive power to energize the voltage generator and operable to disconnect the power from the voltage generator to de-energize the voltage generator.

With this circuit, a power source that generates less voltage than the fully charged capacity of a rechargeable battery can be used to recharge the battery. As is well known in the art, charging systems employing a solar or wind powered voltage source can only use the power delivered by these sources when the source voltage level is above the voltage level of the battery to be charged. When powered by sources such as solar or wind powered voltage sources under less than optimum conditions, the circuit is able to use power not normally available to charge a battery, i.e. power whose voltage is below that of the battery to be charged. For example, the circuit can operate from a power source providing 0.7 volts to fully recharge a 12 volt battery. Also, the circuit can convert power in different forms, such as constant direct current, direct current that varies over time, or alternating current, into a second voltage for charging a battery. Furthermore, current is delivered to the battery in the form of high energy impulses which can improve the proper removal or deposit of material from/on an electrode of the battery. Consequently the life of the battery being charged by the circuit can be significantly extended, and, in many cases, a battery that is unable to be charged by traditional means can be restored to a useable condition.

BRIEF DESCRIPTION OF THE FIGURES

FIG. **1** is a schematic view of a circuit according to an embodiment of the invention.

FIG. **2** is a schematic view of a circuit according to another embodiment of the invention.

FIG. **3** is a schematic view of a circuit according to yet another embodiment of the invention.

FIG. **4** is a schematic view of a circuit according to yet another embodiment of the invention.

FIG. **5** is a schematic view of a circuit that includes a plurality of circuits similar to the one shown in FIG. **3**, according to another embodiment of the invention.

FIG. **6** is a perspective view of one embodiment of the voltage generator of the circuit shown in FIG. **3** and the circuit shown in FIG. **4**, according to an embodiment of the invention.

FIG. **7** is a perspective view of one embodiment of the voltage generator of the circuit shown in FIG. **3** and the circuit shown in FIG. **4**, according to another embodiment of the invention.

FIG. **8** is a perspective view of one embodiment of the voltage generator of the circuit shown in FIG. **3** and the circuit shown in FIG. **4**, according to yet another embodiment of the invention.

FIG. **9** is a perspective view of one embodiment of the voltage generator of the circuit shown in FIG. **3** and the circuit shown in FIG. **4**, according to yet another embodiment of the invention.

FIG. **10** is a schematic view of a system that includes a charging circuit according to an embodiment of the invention.

FIG. **11** is a schematic view of a system that includes a charging circuit according to another embodiment of the invention.

DETAILED DESCRIPTION

FIG. **1** is a schematic view of a circuit **20** according to an embodiment of the invention. The circuit **20** can be used to recharge a battery **22**, and can also be used to repair and/or rejuvenate a battery by improving the proper removal or deposit of material from/on an electrode of the battery. The circuit **20** includes a supply node **24** that can be coupled to a source **26** of power having a voltage. The circuit **20** also includes a voltage generator **28** that generates a magnetic field when the power from the source **26** energizes the generator **28**, and that generates a voltage from the magnetic field's collapse when the generator **28** is de-energized. The circuit **20** also includes an output node **30** that provides access to the voltage generated by the voltage generator **28**, and a switch **32** to allow one to control the flow of power from the source **26** to the generator **28** to energize or de-energize the generator **28**.

In operation, the circuit **20** generates a voltage spike—a high voltage condition lasting for a short period of time—from the collapse of a magnetic field that is generated by the voltage generator **28**. Because the magnetic field collapses quickly, the voltage spike forms quickly, and the voltage in the spike is high. When the magnetic field is generated and then collapses, repeatedly, the circuit **20** generates a series of voltage spikes. Each voltage spike is directed to the output node **30** where it is available for use by the battery **22** or some other device. When the circuit **20** generates a series of voltage spikes, the voltage available at the output node **30** pulsates. Thus, the circuit **20** can apply sharp, high-voltage spikes to recharge the battery **22**.

The voltage generator **28** generates the magnetic field from current flowing through the generator **28**. When the voltage generator **28** is coupled to the power source **26** and the switch **32** is closed, the voltage of the source's power causes current to flow through the generator **28** and toward ground **34**, thus energizing the generator **28**. To collapse the magnetic field generated by the generator **28**, one opens the switch **32** to stop the flow of current through the generator **28**, thus de-energizing the generator **28**.

Because the voltage spikes are brief moments of high voltage, the spikes can be used to provide a battery **22** pulses of substantial current to recharge the battery **22** without generating excessive heat in the batteries anode and cathode plates. Current delivered to the battery in the form of these high energy impulses can improve the proper removal or deposit of material from/on an electrode of the battery. In addition, because the voltage of the voltage spikes is typically greater than the voltage of the power source **26**, the circuit **20** can be used to recharge a battery **22** having a remaining voltage or a fully charged voltage that is greater than the voltage of the power provided by the source **26**.

Still referring to FIG. **1** the power source **26** can be any desired power source capable of providing enough power to energize the voltage generator **28**. For example, in this and certain other embodiments the power source **26** provides a substantially constant 10 volts. Thus, when switch **32** is closed, direct current flows through the voltage generator **28**. In other embodiments, the power source **26** can provide a voltage and current that varies over time. An example of such a power source includes a solar cell array that generates a voltage and current during the night or cloudy days that is less than the voltage and current it generates on a sunny day. Another example of a varying voltage source includes a windmill whose available power varies with wind speed. The advantage of the present invention when using such solar or wind powered voltage sources is that the circuit is able to charge a battery whose voltage is significantly higher than the voltage delivered by the power source. In still other embodiments, the power source **26** can provide a voltage that follows a saw tooth or sinusoidal pattern over time. If the power source **26** provides AC power, the power should be rectified and filtered before powering the voltage generator **28**. Because the pulse of voltage spikes at the output node **30** depends on the opening and closing sequence of the switch **32**, the circuit **20** can also modify the form of the power from the power source **26**.

Still referring to FIG. **1**, the voltage generator **28** includes a component that generates a magnetic field when energized. For example, in some embodiments of the voltage generator, the component is a conductor **36** coiled around an axis (not shown) similar to a conventional inductor, and has an inductance of 200 μH. The strength of the magnetic field generated by the conductor **36** when energized, and thus the voltage generated as the field collapses, depends on the amount of current flowing through the generator **28**, the size of each coil in the conductor, and the number of coils in the conductor. The specific size of each coil in the conductor and the specific number of coils in the conductor can be any desired size and number that provides a desired field strength.

Other embodiments of the component of the voltage generator **28** are possible. For example, as discussed in greater detail in conjunction with FIG. **7**, the component may be a conductor that is substantially straight; not coiled around an axis. As another example, the component may include a conductor in the vicinity of an iron, ferrite, or other magnetically affected material to alter the inductance of the voltage generator.

Still referring to FIG. **1**, the switch **32** can be any switch capable of opening and closing the circuit to allow one to control the flow of current through the generator **28**. For example, in this and certain other embodiments, the switch is a conventional mechanically operated switch. When switch **32** is closed, current flows through the voltage generator **28** to energize the generator **28**. When switch **32** is opened, power stops flowing through the voltage regulator **28** to de-energize the generator **28**.

Other embodiments of the switch **32** are possible. For example, the switch may be electrically operated as discussed in greater detail in conjunction with FIGS. **2-5**.

Still referring to FIG. **1**, the circuit **20** also includes a component for isolating the voltage generated by the voltage generator **28**. For example, in this and certain other embodiments the component includes a diode or other rectifying device **38** that allows current to flow from the generator **28** to the output node **30** but not in the opposite direction. Thus, the voltage generated by the battery **22** can remain isolated from the voltage generator **28** while the generator **28** is energized.

FIG. **2** is a schematic view of a circuit **40** according to another embodiment of the invention. The circuit **40** is similar to the circuit **20** but includes a switch **42** that is electrically operated; not mechanically operated. The switch **42** includes a transistor **44** to control the flow of current through the voltage generator **28**, and a trigger **46** to control the operation of the transistor **44**.

The transistor **44** includes a base **46**, a collector **48**, and an emitter **50**. When the base **46** receives a voltage that is greater than a threshold voltage, current can flow into the collector **48** through the transistor **44** to the emitter **50**, and thus the transistor is closed. When the voltage at the base **46** is less than the threshold voltage, current does not flow into the collector **48** through the transistor **44** and out the emitter **50**, and thus the transistor is open.

The transistor **44** can be any desired transistor that allows one to control the flow of current through the voltage generator **28**. For example, in this and certain other embodiments, the transistor **44** is an NPN bipolar transistor having a threshold voltage of about 0.7 volts. In other embodiments, the transistor **44** may be a PNP bipolar transistor. In still other embodiments, the transistor **44** may be any desired field-effect transistor such as a MOSFET, JFET, or IGBT that has a source that is functionally equivalent to the emitter **50**, a drain that is functionally equivalent to the collector **48**, and a gate that is functionally equivalent to the base **46**. In still other embodiments, the transistor **44** may be any other desired semiconductor switching device.

The trigger **46** includes a DC pulse generating circuit **52** that provides a voltage to the base **46** of the transistor **44** that is greater than the threshold voltage. Thus, when the DC pulse generator **52** provides a voltage to the base **46**, the transistor **44** allows current from the power source **26** to flow through the generator **28**, thus energizing the generator **28**. When the DC pulse generator **52** does not provide a voltage to the base **46**, the transistor **44** prevents current from the power source **26** from flowing through the generator **28**, thus de-energizing the generator **28**.

Still referring to FIG. **2**, the switch **42** also includes diodes **54** and **56** to protect the base **46** and isolate the voltage generated by the generator **28** when the magnetic filed collapses. Diodes **54** and **56** are not necessary to the switch **42**, but protect the transistor **44** by routing any negative high voltage transients to ground **34**.

FIG. **3** is a schematic view of a circuit **60** according to yet another embodiment of the invention. The circuit **60** is similar to the circuit **40** (FIG. **2**) but includes a switch **62** that automatically closes to energize the voltage generator **28** and automatically opens to de-energize the generator **28**—i.e. the circuit **60** oscillates by itself when coupled to the power source **26**. With a switch **62** that automatically opens and closes, the circuit **60** can self oscillate when powered from a source whose voltage and current vary. An example of such a power source includes a solar cell array that generates a voltage and current during the night or cloudy days that is less than the voltage and current it generates on a sunny day. Another example of a varying voltage source includes a windmill whose available power varies with wind speed. When using solar or wind powered voltage sources, the circuit **60** is able to recharge a battery whose voltage is significantly higher than the voltage delivered by the power source.

The switch **62** includes a transistor **44** (bipolar transistor, MOSFET, JFET, IGBT, or any other desired semiconductor switching device) to control the flow of current through the voltage generator **28**, and a trigger **64** to control the operation of the transistor **44**. The trigger **64** generates a voltage opposite to the voltage applied to the transistor's base **46** from the power source **26** (FIG. **1**), and opens the transistor **44** when the generated voltage reduces the voltage applied to the base **46** below the transistor's threshold voltage. The power source **26** powers the voltage generator **28**, the trigger **64**, and the transistor **44**, and thus the circuit **60** self-oscillates to energize and de-energize the voltage regulator **28**.

Still referring to FIG. **3**, in this and certain other embodiments of the trigger **64**, the trigger **64** includes a component that generates a voltage from the magnetic field generated by the voltage generator **28**. For example, in this and certain other embodiments of the trigger **64**, the trigger **64** includes a conductor **66** coiled around an axis (not shown) similar to a conventional inductor, and has an inductance of 200 μh. The coiled conductor **66** can have any desired coil size and any desired number of coils to provide any desired inductance and thus any desired voltage induced by the magnetic field generated by the voltage generator **28**.

The coiled conductor **66** is oriented relative to the voltage generator **28** such that current flowing from the power source **26** flows through the coiled conductor in a direction opposite than the direction that current flowing from the power source **28** flows through the generator **28**. When power from the source is initially applied to the supply node **24**, power flows through the coiled conductor **66** and a voltage is applied at the base of the transistor **44**. The switch **62** closes, and power begins to flow through the voltage generator **28**. The magnetic field generated by the generator **28** induces a voltage in the coiled conductor **66** that opposes the voltage from the power source **26**. When the induced voltage is sufficient to reduce the voltage at the base **46** below the threshold voltage, the transistor **44** opens causing the generator **28** to de-energize. This then causes the magnetic field around the generator **28** to collapse, and thus generate a voltage spike. Because the magnetic field collapses quickly, the voltage spike forms quickly, and the voltage in the spike is high. As the generator's magnetic field collapses, it induces a positive voltage in the coiled conductor **66** that increases and combines with the voltage from the power source **26**. When the combined voltage is above the transistor's threshold voltage the transistor **44** closes causing the generator **28** to re-energize. In this manner the circuit **60** can use the power from the power source **26** to generate a series of voltage spikes by self-oscillating the voltage applied to the base **46** of transistor **44**, and thus the current that flows through the generator **28**.

The oscillation of voltage applied to the base **46** can have any desired period. For example, in this and certain other embodiments the period is 15,000 cycles per second. In other embodiments, the period can be 60 cycles per second. Because the collapse of the generator's magnetic field generates the voltage spike, the amount of voltage in the spike depends on the strength of the magnetic field. Before the magnetic field is fully developed, the strength of the magnetic field depends on the length of time that the current flows through the generator **28**. An oscillation period that is long, i.e. the number of cycles per second is few, increases the length of time that current flows through the generator **28** when the switch **62** is closed. Thus the generated magnetic field is strong, and the spike's voltage is high. An oscillation period that is short, i.e. the number of cycles per second is many, decreases the length of time that current flows through the generator **28** when the switch **62** is closed. Thus the generated magnetic field is weaker, and the spike's voltage is less.

Still referring to FIG. **3**, the switch **60** can include a resistor **68** having any desired resistance. For example, in this and certain other embodiments, the resistor's resistance is 470 Ohms. The resistance of resistor **68** affects the oscillation period of the voltage applied to the base **46** of the transistor **44**. A resistor **68** having a high resistance causes current to flow through the generator **28** for a shorter period than a resistor **68** having a lower resistance.

FIG. **4** is a schematic view of a circuit **70** according to yet another embodiment of the invention. The circuit **70** is similar to the circuit **60** (FIG. **3**) but includes a switch **72** that has a resistor **74** that replaces the diode **54** (FIG. **2**), and resistor **76** to bias the voltage applied to the base **46** of the transistor.

The combination of the resistors **74**, **76** and **78**, affects the oscillation period of the voltage applied to the base **46** of the transistor **44**. Raising the value of resistor **74** causes current to flow through the generator **28** for a shorter period. Raising the value of resistors **76** and/or **78** causes current to flow through the generator **28** for a longer period.

FIG. **5** is a schematic view of a circuit **80** that includes a plurality of circuits **82**, each similar to the circuit **60** (FIG. **3**), according to another embodiment of the invention. Each circuit **82** includes a voltage generator **28**, and a transistor **44**. The circuit **80** includes a trigger **84** that is used to oscillate the flow of power through each circuit **82**. The circuits **82** are arranged so that the power that each voltage generator **28** generates from the collapse of their respective magnetic fields is combined with the power from the others to make a significant amount of power available at the output node **86**. The circuit **80** can have any desired number of circuits **82** to provide a desired amount of power at the output node **86**.

FIG. **6** is a perspective view of a voltage generator's coiled conductor **90** and a trigger's coiled conductor **92** of the circuit **60** shown in FIG. **3** and the circuit **70** shown in FIG. **4**, according to an embodiment of the invention. In this embodiment, both coiled conductors **90** and **92** are components of a coaxial cable that has been coiled. In other embodiments, the coiled conductor **90** can be the trigger's coiled conductor, and the coiled conductor **92** can be the voltage generator's coiled conductor.

FIG. **7** is a perspective view of a voltage generator's conductor **100** and a trigger's conductor **102** of the circuit **60** shown in FIG. **3** and the circuit **70** shown in FIG. **4**, according to another embodiment of the invention. In this embodiment, the voltage generator's conductor **100** and trigger's conductor **102** are shown to be coaxial and straight, not coiled. In other embodiments, the conductor **100** can be the trigger's conductor, and the conductor **102** can be the voltage generator's conductor.

Other embodiments are possible. For example either or both conductors **100** and **102** can have any shape desired to fit any desired application requirements. For example the conductors **100** and **102** can spiral in a single plane as shown in FIG. **9** as would be the case if etched on a common circuit board, or they can serpentine.

FIG. **8** is a perspective view of a voltage generator's conductor **110** and a trigger's conductor **112** of the circuit **60** shown in FIG. **3** and the circuit **70** shown in FIG. **4**, according to another embodiment of the invention. The conductor **110** includes six separate wires **110***a*, **110***b*, **110***c*, **110***d*, **110***e*, **110***f* that each generate a portion of the magnetic field generated by the generator **28** (FIG. **5**) when current flows through the conductor **110**, and generate a portion of the voltage generated by the generator from the collapse of their respective portions of the magnetic field. The conductor **112** generates a voltage opposite to the voltage applied to the transistor's base **46** (shown in FIG. **5**, but omitted from FIG. **8** for clarity), and opens the transistor **44** (shown in FIG. **5**, but omitted from FIG. **8** for clarity) when the generated voltage reduces the voltage applied to the base **46** below the transistor's threshold voltage.

FIG. **9** is a perspective view of a voltage generator's conductor **120** and a trigger's conductor **122** of the circuit **60** shown in FIG. **3** and the circuit **70** shown in FIG. **4**, according to another embodiment of the invention. The conductor **120** includes two separate traces **120***a* and **120***b* disposed in/on a circuit board that each generate a portion of the magnetic field generated by the generator **28** (FIG. **5**) when current flows through the conductor **120**, and generate a portion of the voltage generated by the generator from the collapse of their respective portions of the magnetic field. The conductor **122** generates a voltage opposite the voltage applied to the transistor's base **46** (shown in FIG. **5**, but omitted from FIG. **9** for clarity), and opens the transistor **44** (shown in FIG. **5**, but omitted from FIG. **9** for clarity) when the generated voltage reduces the voltage applied to the base **46** below the transistor's threshold voltage.

FIG. **10** is a schematic view of a system **130** that includes a charging circuit **132**, according to an embodiment of the invention. The charging circuit **132** can be the circuit **20** (FIG. **1**), the circuit **40** (FIG. **2**), the circuit **60** (FIG. **3**) and/or the circuit **70** (FIG. **4**). The system **130** also includes a circuit controller **134** that controls the connection of the power source **26** to the supply node **24** (FIG. **1**). The circuit controller **134** can also, if desired, control the connection of the battery **22** to a load **136**, such as an electric motor, (if present).

In this and certain other embodiments, the circuit controller **134** includes a processor or microcontroller (not shown) that executes instructions expressed in software, and one or more circuits (also not shown) to monitor operating conditions of the load **136**, the battery **22**, and/or the charging circuit **132**. In this and certain other embodiments, the controller **134** includes a circuit to confirm the presence of the battery **22** before connecting the charging circuit **132** to charge the battery **22**. The controller **134** may also include other circuits to detect the voltage and/or temperature of the battery **22** to monitor the voltage and/or temperature and stop the charging process when the battery **22** is fully charged.

FIG. **11** is a schematic view of a system **140** that includes a charging circuit **132**, according to another embodiment of the invention. The system **140** is similar to the system **130** except the system **140** includes two batteries **142** and **144**. In this and certain other embodiments, each battery **142** and **144** can deliver the amount of power that the load **136** requires, and thus alternately power the load **136**. A benefit of this arrangement is that while one of the batteries **142** and **144** powers the load **136**, the other battery **144** or **142** can be recharged by the charging circuit **132**. Thus, in this and certain other embodiments, the circuit controller **134** can also include a switch (not shown) that connects one of the batteries **142** or **144** to the charging circuit **132** to recharge the battery while the other battery powers the load **136**. And, when the powering battery is depleted or the charging battery is fully charged, the switch can connect the recharged battery to the load **136** to power the load, and connect the depleted battery to the charging circuit **132** to recharge the battery.

The preceding discussion is presented to enable a person skilled in the art to make and use the invention. The general principles described herein may be applied to embodiments and applications other than those detailed above without departing from the spirit and scope of the present invention. The present invention is not intended to be limited to the embodiments shown, but is to be accorded the widest scope consistent with the principles and features disclosed or suggested herein.

What is claimed is:

1. A circuit for generating a voltage, the circuit comprising:

a supply node coupled to a conductor operable to receive power having a first voltage;

a voltage generator comprising a single conductor operable to generate a magnetic field when the voltage generator is energized by the power, and operable to generate a second voltage substantially larger than the first voltage, the second voltage generated from the magnetic field's collapse when the voltage generator is de-energized, wherein the voltage generator includes the conductor coiled around an iron bar that generates the second voltage from the magnetic field's collapse;

an output node coupled directly to the conductor operable to provide access to the second voltage; and

a switch operable to allow the voltage generator to receive power to energize the voltage generator, and operable to disconnect the power from the voltage generator to de-energize the voltage generator.

2. The circuit of claim **1** wherein the power includes direct current.

3. The circuit of claim **1** wherein the power includes rectified, filtered alternating current.

4. The circuit of claim **1** wherein the first voltage varies.

5. The circuit of claim **1** wherein the switch includes a mechanical switch.

6. The circuit of claim **1** wherein the switch includes a semiconductor switching device.

7. The circuit of claim **1** wherein the switch includes a transistor.

8. The circuit of claim **1** wherein the switch includes a trigger operable to open the switch.

9. The circuit of claim **1** wherein the switch includes:

a field effect transistor having a gate, a drain, and a source, wherein current flows from the drain to the source when a voltage greater than or equal to a threshold voltage is applied to the gate, and current does not flow from the drain to the source when a voltage less than the threshold voltage is applied to the gate; and

a trigger operable to reduce the gate's voltage below the threshold voltage.

10. The circuit of claim **1** wherein the switch includes:

a transistor having a base, a collector, and an emitter, wherein current flows from the collector to the emitter when a voltage greater than or equal to a threshold voltage is applied to the base, and current does not flow from the collector to the emitter when a voltage less than the threshold voltage is applied to the base; and

a trigger operable to reduce the base's voltage below the threshold voltage.

11. The circuit of claim **1** wherein the switch includes a trigger operable to close the switch.

12. The circuit of claim **1** wherein the switch includes:

a transistor having a base, a collector, and an emitter, wherein current flows from the collector to the emitter when a voltage greater than or equal to a threshold voltage is applied to the base, and current does not flow from the collector to the emitter when a voltage less than the threshold voltage is applied to the base; and

a trigger operable to increase the base's voltage above the threshold voltage.

13. The circuit of claim **1** wherein the switch includes:

a field effect transistor having a gate, a drain, and an source, wherein current flows from the drain to the source when a voltage greater than or equal to a threshold voltage is applied to the gate, and current does not flow from the drain to the source when a voltage less than the threshold voltage is applied to the gate; and

a trigger operable to increase the gate's voltage above the threshold voltage.

14. The circuit of claim **1**:

wherein the switch closes to energize the voltage generator and opens to de-energize the voltage generator, repeatedly, to generate a pulsating current; and

further comprising a component operable to modify how long the switch remains closed each time it's closed.

15. The circuit of claim **1**:

wherein the switch closes to energize the voltage generator and opens to de-energize the voltage generator, repeatedly, to generate a pulsating current; and

further comprising a resistor operable to modify how long the switch remains closed each time it's closed.

16. The circuit of claim **1** further comprising a diode to isolate the second voltage at the output node.

17. The circuit of claim **1** further comprising:

a battery coupled to the output node and operable to be charged by the second voltage;

a diode operable to prevent the battery from generating a voltage across the voltage generator while the power energizes the voltage generator.

18. The circuit of claim **1** wherein the voltage generator oscillates between the energized state and the de-energized state.

19. The circuit of claim **1** wherein the voltage generator automatically oscillates between the energized state and the de-energized state when the supply node is coupled to power.

20. A battery charger comprising:

a power source operable to provide power having a first voltage;

a circuit operable to generate a second voltage, the circuit including:

  a supply node coupled to the power source and coupled to a conductor node,

  an inductive voltage generator, having an air, iron, or ferrite core, coupled to the conductor node and operable to generate a magnetic field when the voltage generator is energized by the power, and operable to generate the second voltage on the conductor node from the magnetic field's collapse when the voltage generator is de-energized, wherein the second voltage is substantially greater than the first voltage,

  an output node coupled directly to the conductor node to provide access to the second voltage, and

  a switch operable to energize the voltage generator by allowing the voltage generator to receive the power, and operable to disconnect the power from the voltage generator to de energize the voltage generator.

21. The battery charger of claim **20** wherein the output node is coupled to a battery to be charged.

22. The battery charger of claim **20** wherein:

the output node is coupled to a battery to be charged, the battery having a third voltage, and

the first voltage is less than the third voltage.

23. The battery charger of claim **20** wherein the first voltage varies.

24. The battery charger of claim **20** wherein the power includes rectified, filtered alternating current.

25. The battery charger of claim **20** wherein the second voltage is high and the circuit is operable to provide the output node a large amount of current.

26. The battery charger of claim **20** further comprising a battery having a third voltage and connected to the output node, and wherein the circuit charges the battery while the first voltage is less than the third voltage.

27. The battery charger of claim **20** wherein the second voltage is used to charge at least one of the following types of batteries: a lead acid battery, a nickel cadmium battery, a nickel metal hydride battery, and a lithium-ion battery.

28. A method for charging a battery, the method comprising:

energizing a voltage generator comprising a single conductor of a circuit from a conductor node coupled to a power source to generate a magnetic field in the voltage generator, the magnetic field generated about an air, iron or ferrite core;

operating a switch to allow the voltage generator to receive power to energize the voltage generator, and to disconnect the power from the voltage generator to de-energize voltage generator to collapse the magnetic field in the voltage generator;

generating a voltage from the collapsing field on the conductor node of the voltage generator, wherein the generated voltage is substantially larger than the input voltage; and

isolating the voltage at an output node directly coupled to the conductor node of the circuit.

29. The method of claim **28** wherein energizing the voltage generator includes closing a switch to allow power to flow from a power source through the voltage generator.

30. The method of claim **28** wherein de-energizing the voltage generator includes opening a switch to prevent power from a power source from flowing through the voltage generator.

31. The method of claim **28** wherein energizing the voltage generator includes applying a voltage to a transistor's base to allow power to flow from a power source through the voltage generator.

32. The method of claim **28** wherein energizing the voltage generator includes applying a voltage to a field effect transistor's gate to allow power to flow from a power source through the voltage generator.

33. The method of claim **28** wherein de-energizing the voltage generator includes reducing a voltage applied to a transistor's base to prevent power from a power source from flowing through the voltage generator.

34. The method of claim **33** wherein de-energizing the voltage generator includes generating a trigger voltage to reduce a voltage applied to a transistor's base to prevent power from a power source from flowing through the voltage generator.

35. The method of claim **28** wherein de-energizing the voltage generator includes reducing a voltage applied to a field effect transistor's gate to prevent power from a power source from flowing through the voltage generator.

36. The method of claim **35** wherein de-energizing the voltage generator includes generating a trigger voltage to reduce a voltage applied to a transistor's gate to prevent power from a power source from flowing through the voltage generator.

37. The method of claim **28** further comprising:

re-energizing the voltage generator of the circuit to generate a subsequent magnetic field in the voltage generator; and

de-energizing the voltage generator to collapse the subsequent magnetic field in the voltage generator.

38. The method claim **28** further comprising capturing the voltage with a battery coupled to the output node.

39. A system comprising:

a battery charger that includes:

a power source operable to provide power having a first voltage;

a circuit operable to generate a second voltage, the circuit including:

a supply node coupled to the power source and coupled to a conductor node,

a voltage generator having a single conductor coupled to the conductor node and multiple coiled coaxial conductors operable to generate a magnetic field when the voltage generator is energized by the power, and operable to generate the second voltage on the conductor node from the magnetic field's collapse when the voltage generator is de-energized, wherein the second voltage is substantially greater than the first voltage;

an output node coupled directly to the conductor node to provide access to the second voltage, and

a switch operable to energize the voltage generator by allowing the voltage generator to receive the power, and operable to disconnect the power source from the voltage generator to de-energize the voltage generator;

a battery operable to power a load; and

a circuit controller operable to selectively connect and disconnect the battery charger to the battery.

40. The system of claim **39** wherein the circuit controller includes a processor operable to execute instructions.

41. The system of claim **39** wherein the circuit controller includes a circuit operable to confirm the presence of the battery before connecting the battery charger to the battery.

42. The system of claim **39** wherein the circuit controller monitors the voltage and/or temperature of the battery, and disconnects the battery from the battery charger when the battery is charged.

43. The system of claim **39** further comprising a second battery operable to power a load.

44. The system of claim **39** wherein the second voltage is used to charge at least one of the following batteries: a lead acid battery, a nickel cadmium battery, a nickel metal hydride battery, and a lithium-ion battery.

45. The system of claim **39** wherein the second voltage is used to rejuvenate at least one of the following batteries: a lead acid battery, a nickel cadmium battery, a nickel metal hydride battery, and a lithium-ion battery.

46. The circuit of claim **39** wherein the first voltage is less than the voltage of the battery while the battery charger charges the battery.

47. A circuit for generating a voltage, the circuit comprising:

a supply node operable to receive power having a first voltage;

a voltage generator comprising one conductor operable to generate a magnetic field when the voltage generator is energized by the power, and operable to generate a second voltage substantially larger than the first voltage, the second voltage generated from the magnetic field's collapse when the voltage generator is de-energized, wherein the voltage generator includes a substantially straight conductor that generates the second voltage from the magnetic field's collapse;

an output node directly coupled to the conductor operable to provide access to the second voltage; and

a switch operable to allow the voltage generator to receive power to energize the voltage generator, and operable to disconnect the power from the voltage generator to de-energize the voltage generator.

48. A circuit for generating a voltage, the circuit comprising:

a supply node operable to receive power having a first voltage;

a voltage generator having one conductor operable to generate a magnetic field when the voltage generator is energized by the power, and operable to generate a second voltage substantially larger than the first voltage, the second voltage generated from the magnetic field's collapse when the voltage generator is de-energized, wherein the voltage generator includes multiple, coiled conductors coupled parallel or coaxial to each other;

an output node directly coupled to the conductor operable to provide access to the second voltage; and

a switch operable to allow the voltage generator to receive power to energize the voltage generator, and operable to disconnect the power from the voltage generator to de-energize the voltage generator.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO.	: 7,990,110 B2	Page 1 of 1
APPLICATION NO.	: 11/592633	
DATED	: August 2, 2011	
INVENTOR(S)	: John C. Bedini et al.	

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

- In Claim 20, Column 10, Line 28, "generator to de energize the voltage" should read --generator to de-energize the voltage--

Signed and Sealed this
Fourth Day of October, 2011

David J. Kappos

David J. Kappos
Director of the United States Patent and Trademark Office

The Attractions of Magnetism

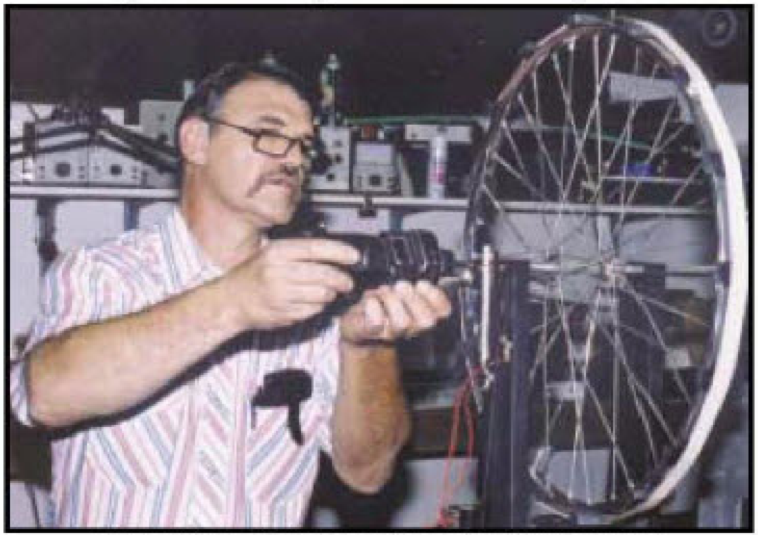
Could a Little Child Be Leading Us to a Free Energy Future?

The search for new energy technology takes us to northern Idaho to meet a ten-year-old girl who won a science fair with a battery-charging motor. She describes it as an advanced design that extends the life of batteries for an amazing length of time. The motor was designed by John Bedini and built by her. We meet him first.

More widely known as an audio-amplifiers expert, Bedini's name is intertwined with "free energy" history. Witnesses saw his machines running successfully, but later others were unable to build devices according to his published instructions. His circuitry was mentioned favorably at a conference in Switzerland recently.

Aware of the controversies, with mixed feelings I drove into the Idaho panhandle, past a warehouse for survivalists' supplies. My hope is that he will give clues so others can duplicate his successes.

10-year-old Shawnee Baughman with her award-winning science



Inventor John Bedini tweaks a working model of his magnet motor

Explaining his theory about such devices, new-energy theorist Thomas Bearden is writing prolifically this year. Retired from electronic warfare studies and aerospace work, Bearden is the leading advocate of scalar potential electromagnetics, and he explains how the sea of energy we live in—an energetic flux of virtual particles—could be engineered to do work in the physical world.

Bearden also has a theory about another of Bedini's "scalar" inventions—one which can increase enjoyment of music. After a six-year struggle, Bedini was granted US Patent 5,487,057 for a mechanism for reducing electronic distortion in digital and analog recording and playback. Bearden (writing in *Explore Magazine* Vol. 7, No. 4, pp 53-63) says the patent examiner couldn't understand the mechanism, because Bedini's nonlinear optics process was not found in audio-, or classical electromagnetics textbooks. Meanwhile, John and his brother Gary were already selling the stress-defect-relieving devices. The process even works for media such as color film. Bearden explains Bedini's process as self-oscillating, optical-electronics, and hopes that even structural metals can eventually be treated with it to reduce stress defects. Is this negative entropy—self-ordering in the physical world?

Bearden adds that most really *new* things are invented not by academic teams or corporate scientists but by the lone "independent, fiercely creative people."

I meet Bedini at his business, surrounded by electronics equipment. The back room looks like a museum of small prototypes of unusual motor/generators. Some are pictured on websites http://rand.nidlink.com/John1 or http:/www.icehouse.net/john1/tesla.html.

He says his knowledge is on the internet, and now it's up to others to build the devices. He says they have to experiment themselves, and it reminds me that he taught a little girl how to make a motor which drove science teachers nuts—to see a little motor made of plastic with no return paths for the magnetics.

"The funny thing was that her father bent a coat hanger and put a coil above the motor and used it as a generator. The motor ran much longer under the load than they had expected."

John Bedini was roaming the "free energy" scene in California in the 1970s and early 1980s, collecting knowledge about medical as well as energy devices. He had an electronics business in Sylmar, and at home he experimented with windmills and other systems. The utility company objected—he was hooked up to their

BY JEANE MANNING

Continued on Page 64

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Continued from Page 32

power lines and if his system were to backfeed, it could extinguish the lights in the neighborhood. He disagreed. As he tells it, the officials' final word was "we think you're stealing power" and they took their meter off the building. However, his lights were still on at night, because of his energy inventions, he tells me. Finally they struck a deal--he would have his power meter back but would pay a high fee for the service.

The power company almost took away their hookup to his shop, but it was in an industrial area and they would have had to remove a three-phase transformer and therefore deprive the other businesses of power. "They found that when they switched off all the power in the shop nothing (electrical) was being drawn, but the machines kept running."

He published instructions for an energy device which Jim Watson of Colorado Springs then built—large-scale with a heavy flywheel. Watson demonstrated it at the 1984 Bicentennial symposium celebrating Nikola Tesla's arrival in the USA.

At the same meeting, Bedini displayed a circuit which charges batteries. Only one engineer out of the audience–Eike Mueller of the European space agency–got up and measured Bedini's apparatus. He affirmed that it was charging the batteries.

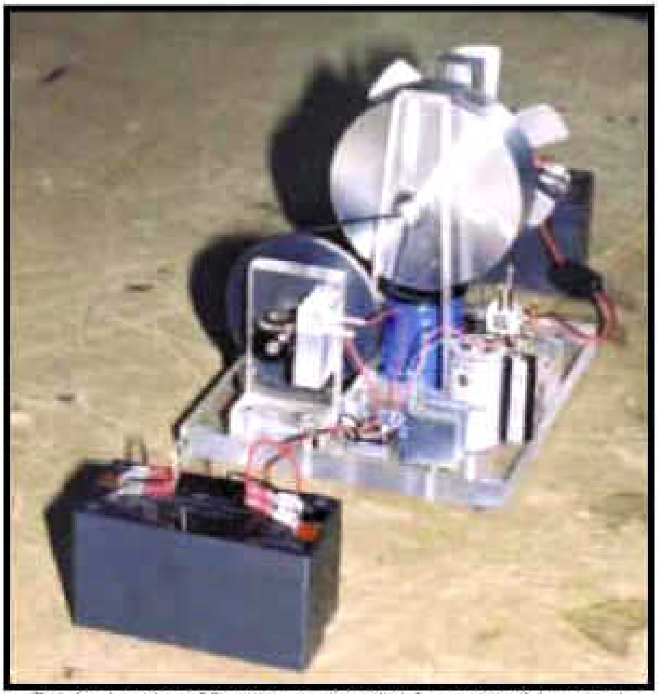
Dr. Hans Nieper's book *Revolution in Technology, Medicine and Society* states that Bedini's converter was 800% efficient in initial tests, and that 26 independent researchers successfully duplicated the device about which Bedini reported.

However, the staff of the no-longer-published magazine *Energy Unlimited* was unable to replicate the device, and consulting engineer George Hathaway criticized Mueller's measurements.

On the other hand, a presenter at the 1985 USPA conference, Ken Moore, found that his model of Bedini's G-Field Generator increased speed as its load increased. He also witnessed a Bedini prototype successfully operating.

The same year, radio KABC talk show host Bill Jenkins used his guest speaker's spot at a March 12 Town Hall forum at the Biltmore Hotel in Los Angeles to announce a free energy device, with Bedini and Steven Werth. The two demonstrated what was described as a Kromrey gravity-field generator with 180% efficiency, powered by a battery bank which required no recharging from an outside source.

A newspaper account said the audience included public utility representatives and investment brokers. Bedini, then 37, told the forum that he planned to make his generator universally available to the public at a nominal cost, instead of selling to the highest bidder. He described his working model as using stressed, pulsed scalar waves out of phase, to tap zero-point energy of the vacuum of space. The concept was not found in physics books, but is perfectly natural and it works, he said.



Toy-sized version of Bedini motor intended for commercial production.

Jenkins had publicly introduced concepts such as scalar interferometry through one of his radio guests, physicist Bearden.

How did the civic officials at the Biltmore forum react to a "free energy" demonstration--light bulbs strung across their luncheon plates? Bedini recalls the growled demands to remove the d___ bulbs so they could eat. "Free energy" was not a part of their reality.

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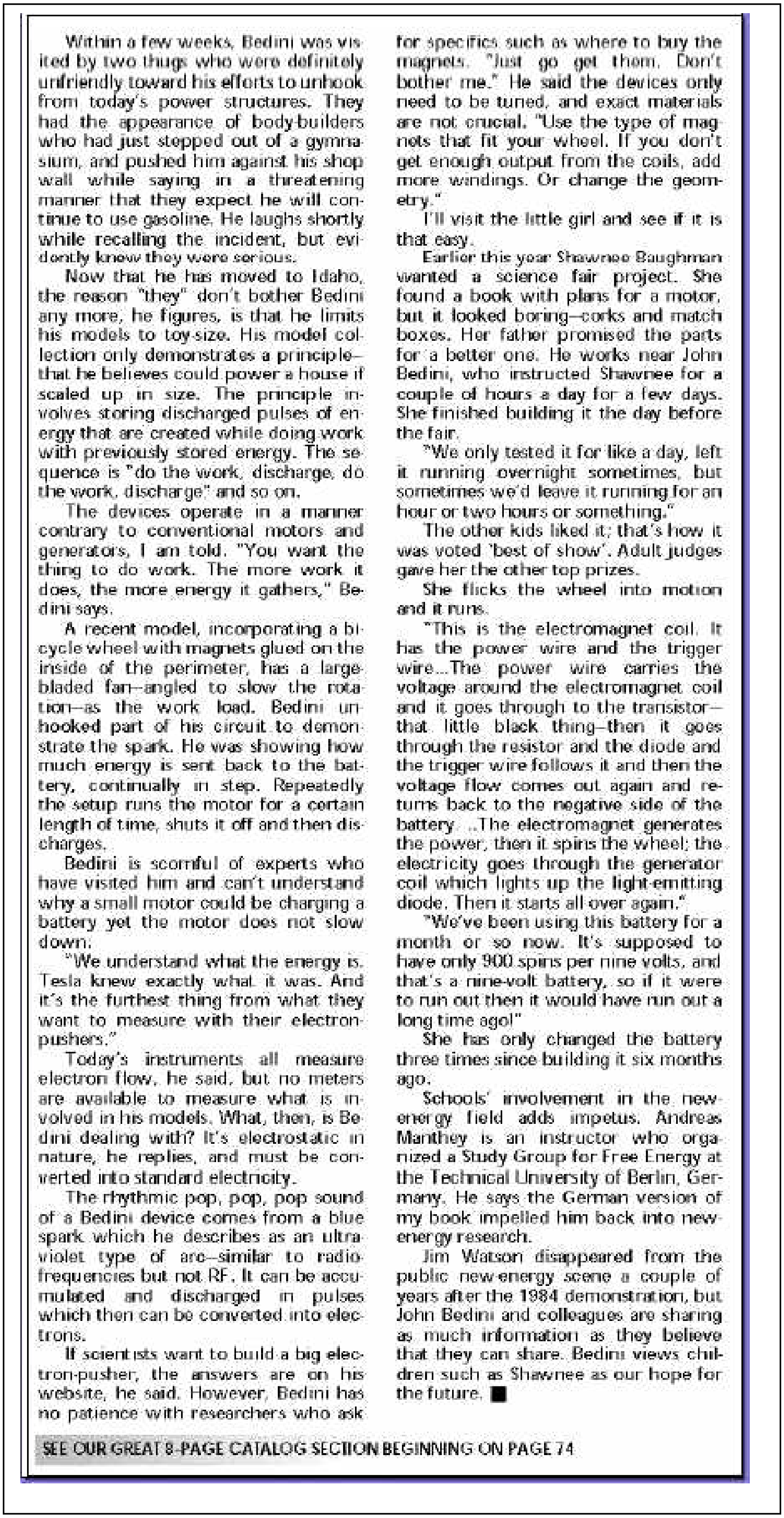

Within a few weeks, Bedini was visited by two thugs who were definitely unfriendly toward his efforts to unhook from today's power structures. They had the appearance of body-builders who had just stepped out of a gymnasium, and pushed him against his shop wall while saying in a threatening manner that they expect he will continue to use gasoline. He laughs shortly while recalling the incident, but evidently knew they were serious.

Now that he has moved to Idaho, the reason "they" don't bother Bedini any more, he figures, is that he limits his models to toy-size. His model collection only demonstrates a principle–that he believes could power a house if scaled up in size. The principle involves storing discharged pulses of energy that are created while doing work with previously stored energy. The sequence is "do the work, discharge, do the work, discharge" and so on.

The devices operate in a manner contrary to conventional motors and generators, I am told. "You want the thing to do work. The more work it does, the more energy it gathers," Bedini says.

A recent model, incorporating a bicycle wheel with magnets glued on the inside of the perimeter, has a large-bladed fan–angled to slow the rotation–as the work load. Bedini unhooked part of his circuit to demonstrate the spark. He was showing how much energy is sent back to the battery, continually in step. Repeatedly the setup runs the motor for a certain length of time, shuts it off and then discharges.

Bedini is scornful of experts who have visited him and can't understand why a small motor could be charging a battery yet the motor does not slow down.

"We understand what the energy is. Tesla knew exactly what it was. And it's the furthest thing from what they want to measure with their electron-pushers."

Today's instruments all measure electron flow, he said, but no meters are available to measure what is involved in his models. What, then, is Bedini dealing with? It's electrostatic in nature, he replies, and must be converted into standard electricity.

The rhythmic pop, pop, pop sound of a Bedini device comes from a blue spark which he describes as an ultraviolet type of arc–similar to radio-frequencies but not RF. It can be accumulated and discharged in pulses which then can be converted into electrons.

If scientists want to build a big electron-pusher, the answers are on his website, he said. However, Bedini has no patience with researchers who ask for specifics such as where to buy the magnets. "Just go get them. Don't bother me." He said the devices only need to be tuned, and exact materials are not crucial. "Use the type of magnets that fit your wheel. If you don't get enough output from the coils, add more windings. Or change the geometry."

I'll visit the little girl and see if it is that easy.

Earlier this year Shawnee Baughman wanted a science fair project. She found a book with plans for a motor, but it looked boring–corks and match boxes. Her father promised the parts for a better one. He works near John Bedini, who instructed Shawnee for a couple of hours a day for a few days. She finished building it the day before the fair.

"We only tested it for like a day, left it running overnight sometimes, but sometimes we'd leave it running for an hour or two hours or something."

The other kids liked it; that's how it was voted 'best of show'. Adult judges gave her the other top prizes.

She flicks the wheel into motion and it runs.

"This is the electromagnet coil. It has the power wire and the trigger wire...The power wire carries the voltage around the electromagnet coil and it goes through to the transistor–that little black thing–then it goes through the resistor and the diode and the trigger wire follows it and then the voltage flow comes out again and returns back to the negative side of the battery. ..The electromagnet generates the power, then it spins the wheel; the electricity goes through the generator coil which lights up the light-emitting diode. Then it starts all over again."

"We've been using this battery for a month or so now. It's supposed to have only 900 spins per nine volts, and that's a nine-volt battery, so if it were to run out then it would have run out a long time ago!"

She has only changed the battery three times since building it six months ago.

Schools' involvement in the new-energy field adds impetus. Andreas Manthey is an instructor who organized a Study Group for Free Energy at the Technical University of Berlin, Germany. He says the German version of my book impelled him back into new-energy research.

Jim Watson disappeared from the public new-energy scene a couple of years after the 1984 demonstration, but John Bedini and colleagues are sharing as much information as they believe that they can share. Bedini views children such as Shawnee as our hope for the future. ■

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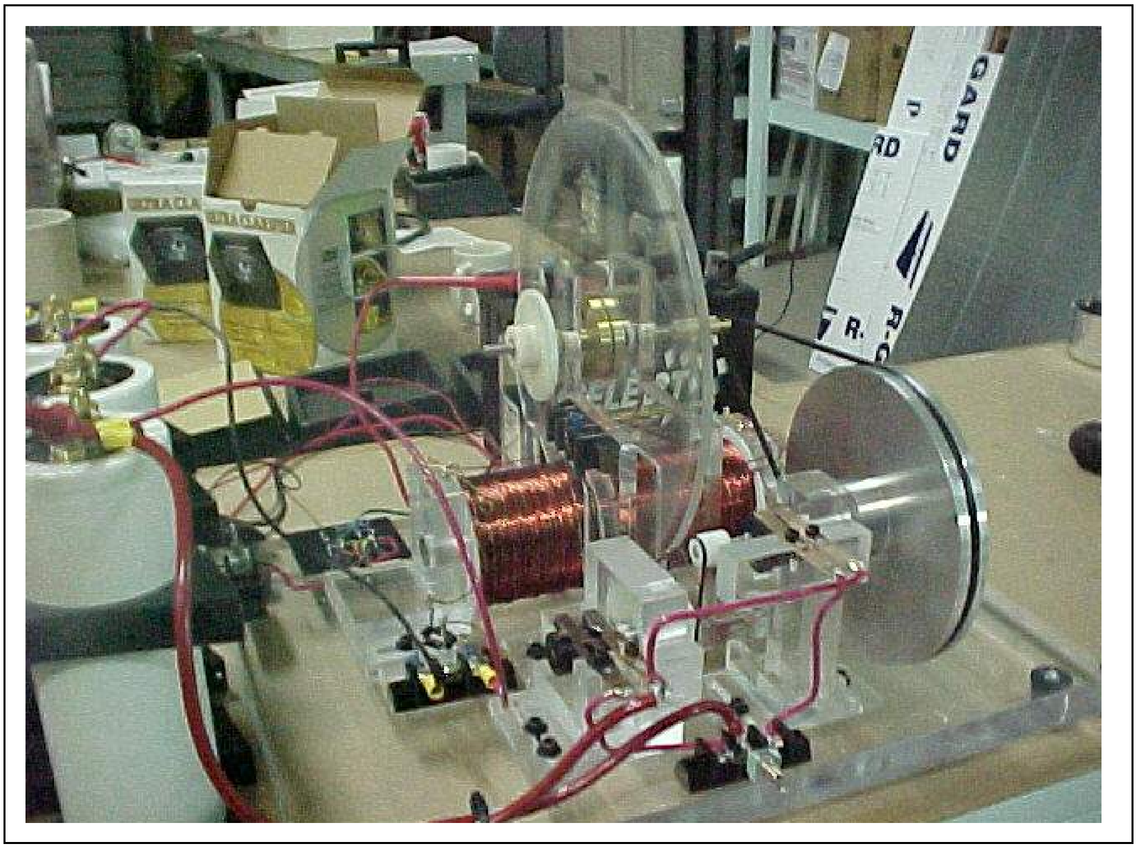

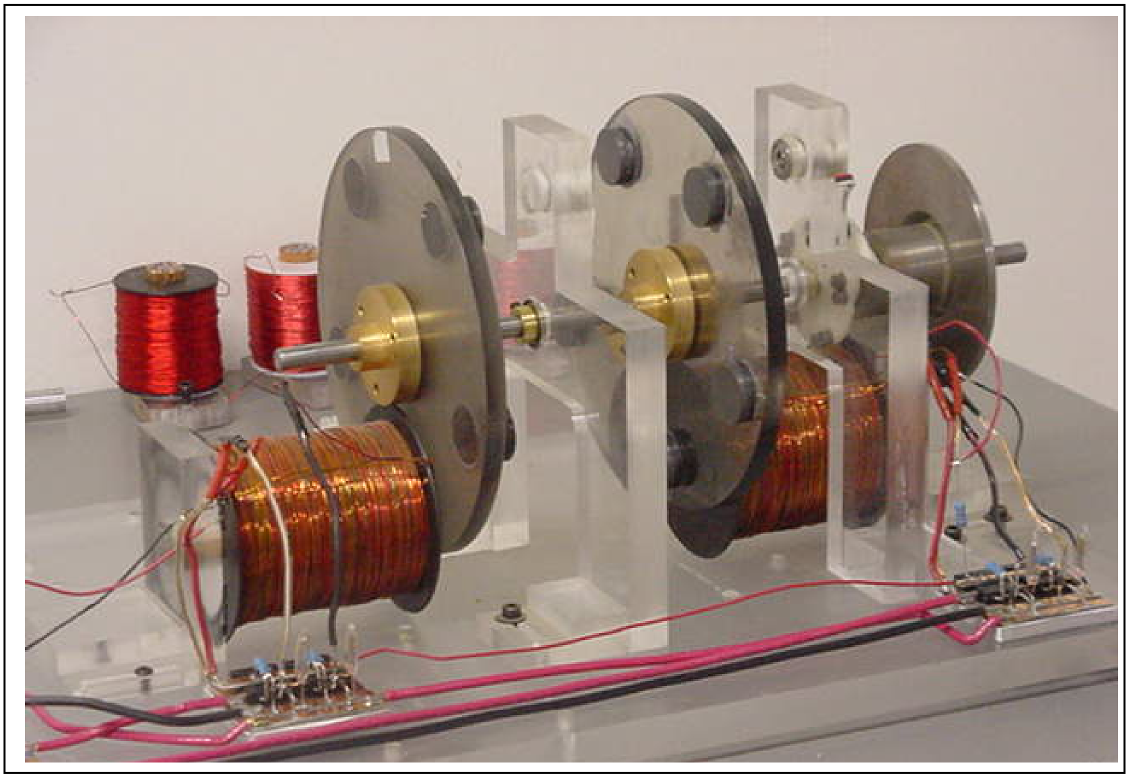

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by Peter Lindemann and Aaron Murakami

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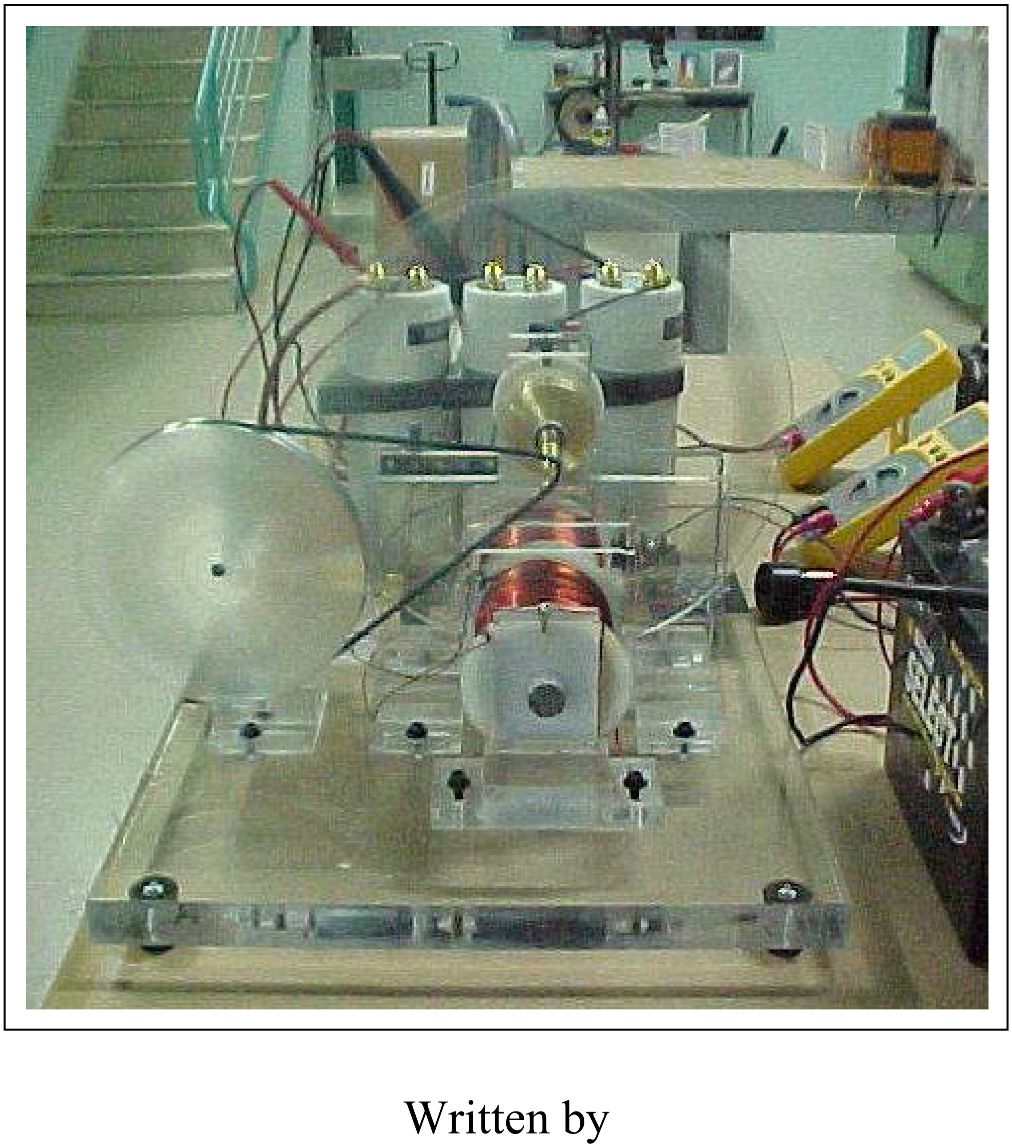
Bedini SG

The Complete Intermediate Handbook

Understanding Circuit Optimization and Capacitor Discharge



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Bedini SG

The Complete Intermediate Handbook

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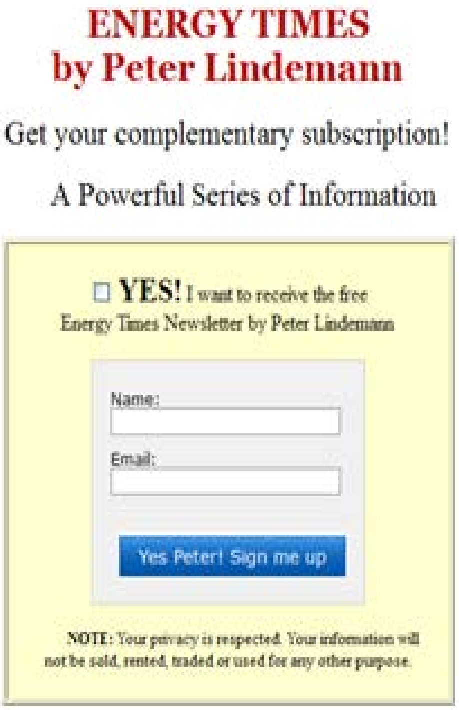

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Foreword

This book is the second in the series of Bedini SG Handbooks. The full instructions on how to build the Bedini SG Energizer are in the first book of the series titled **Bedini SG, the Complete Beginner's Handbook**. If you are not familiar with the Bedini SG project, then you can learn more HERE.

This book does not review any material from the first book. It simply picks up the instructions at the Intermediate Level. For instance, the first book assumed the reader did not know anything about electronic parts or circuits. This book, on the other hand, assumes the reader does have a working knowledge of electronics and circuit functions.

Since the release of the first book, **Bedini SG, the Complete Beginner's Handbook**, the entire Bedini SG world has been taken to the next level. It includes the most detailed instructions on how to build the machine, coupled with a comprehensive explanation of the theory of operation. It also introduces the "attraction mode" of operation for best performance.

This book picks up where the Beginner's Handbook leaves off. It starts with methods to "fine tune" the oscillator, how to charge capacitors and discharge them into the batteries, and other related concepts. It also includes more advanced theoretical discussions about Tesla's methods for creating a "power gain" in a circuit and the difference between energy conservation and energy recycling.

After learning this material, you should be able to raise the efficiency of your Bedini SG project to levels that you may not have thought possible.

Peter Lindemann (March 2013)

Introduction

"There are only two ways to live your life. One is as though nothing is a miracle. The other is as though everything is a miracle."
Albert Einstein

The first time I asked John Bedini how the energizer worked, he looked me straight in the eye and said "it's a trick." This was not the answer I wanted. It made me really mad! For me, the idea of a "trick" meant that it was not real, or that I was being fooled in some way. Luckily, this is not what John meant. But what he did mean took me years to understand.

The machine does NOT break any Laws of Nature. It does, however, take advantage of a number of narrow "windows of opportunity" which mainstream science has not spent much time exploring. When measured directly, the over-all efficiency of the machine is always under 100%. However, when built properly, the battery being charged by the system always charges faster than the battery being drained by the system.

This apparent paradox is the "trick" that John was referring to. Electrically, the machine does not produce a "net energy gain." The machine does not produce more electricity than it uses. It does, however, produce an unusual set of conditions that the batteries translate into an accelerated charging rate. The end result is an energy gain that can be accessed from the batteries over time.

This Intermediate Handbook is the next step in the unraveling of some of John's "tricks", what they are, why they work, and how you can do it to.

Peter Lindemann, D.Sc.
Aaron Murakami, BSNH

Chapter One

Fine Tuning the SG Energizer

Introduction:

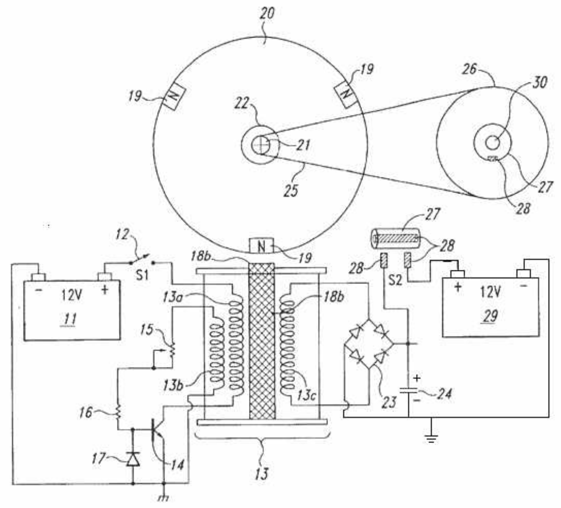
It is assumed that, if you are reading this, you own a copy of the first book in the series, **Bedini SG, the Complete Beginner's Handbook**, and that you have a working model of an SG Energizer in your possession.

The purpose of this chapter is to guide you, step-by-step, to make a number of minor modifications to the machine so that it draws less energy from the run battery, delivers more energy to the charging battery, and at the same time, produces more mechanical energy on the wheel.

If you built your model based on the instructions in the Beginner's Handbook, it is probably running pretty well already. But guess what? It can run better! So, let's get started.

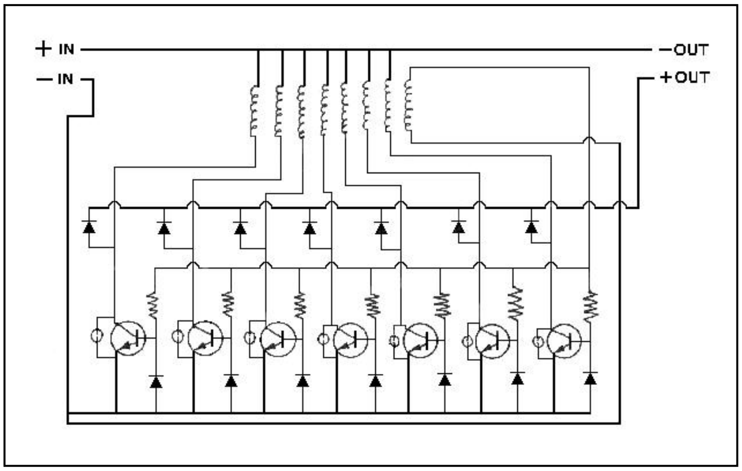
Basic Tuning:

If you have done your research, you know that the Bedini SG Energizer is based on John Bedini's US Patent #6,545,444. Here is a copy of the diagram from that patent. You can see that the circuit includes a "variable resistor" in the section that connects the trigger coil to the base of the transistor (component #15).

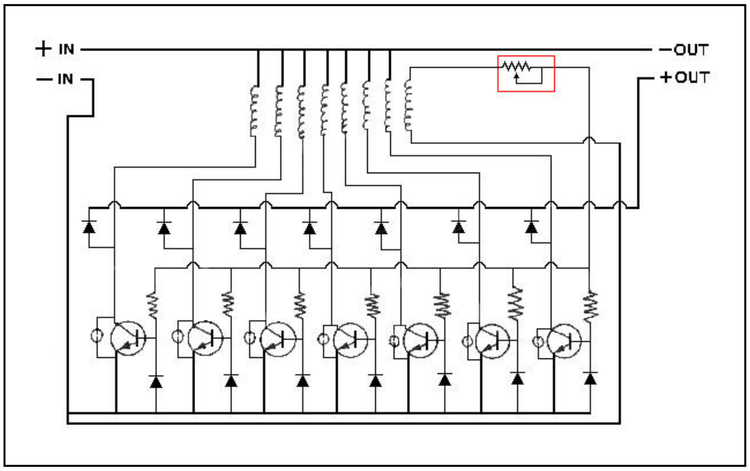


It also includes a capacitor (component #24) and a means to discharge the capacitor periodically into the second battery (components #27 and 28).

If you have looked on the internet or into some of the discussion forums for the SG or Monopole, you have probably heard of a simple method of "fine tuning" the SG Energizer. When there is only one power coil, this process is quite simple. But when there are multiple power windings, as in your Beginner's model, the process has a few more details associated with it.



The simple method involves replacing the 470 Ohm base resistors on each transistor with a 100 Ohm resistor and then inserting a 1 watt 1k Ohm variable resistor (potentiometer) in series, as shown in the second drawing. (Red box)



To "tune" the unit, simply start it up and find the place on the potentiometer where the wheel is turning the fastest while the circuit is drawing the least current from the run battery. Obviously, you would need an amp meter on the run battery and a tachometer on the wheel to determine these conditions.

Some experimenters thought this information should have been included in the Beginner's Handbook. While it was being written, I specifically asked John about this, and he said that he wanted beginners to build the basic model and get it running first, so the 470 Ohm fixed resistors were specified on the base of each transistor in that book.

That said, while the method of placing a 1k Ohm potentiometer in series with the 100 Ohm resistors does give a reasonable measure of variability, it does NOT really set up the conditions for "fine tuning" the system. This is especially true of coils that have multiple strands of wire on them and multiple transistors.

Fine Tuning:

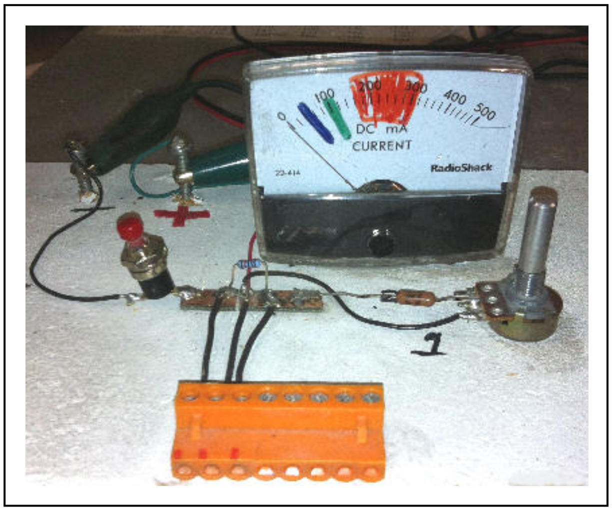
To understand why this is true, we have to look closely at the timing of the transistor switching, down at the micro-second level. "Fine tuning" is about optimizing the operations of the oscillator. If you have a dual-trace oscilloscope, you can watch the switching of any two of the transistors simultaneously. If you watch enough sets, with the time base short enough, you will start to see that they can switch one or two micro-seconds apart.

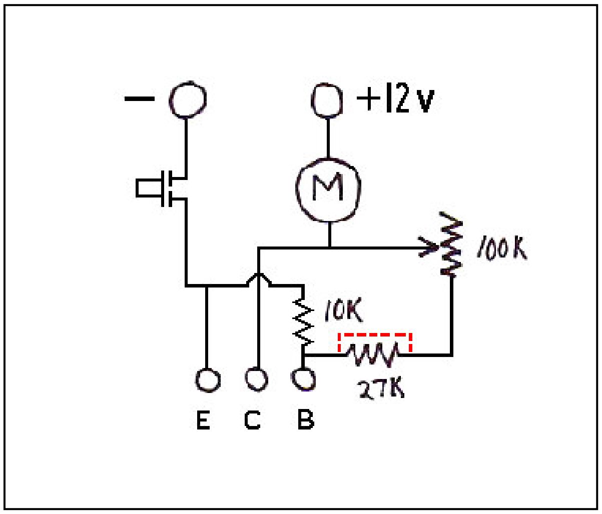
This is especially important when the transistors are turning OFF because that is when they are trying to discharge their energy into the recovery circuit. If a few transistors are turning OFF while the rest are staying ON, even for a few micro-seconds, this can blunt the inductive kickback of the system. You quickly realize that what you want is for all of the transistors to turn ON and turn OFF at *exactly* the same time, so the energy can flow through the machine perfectly smoothly.

The reason the transistors may not be perfectly synchronized at this point is that you are using electronic components that are mass-produced. That means that they each may have slightly different operating specifications. While they are all "very close" and "within acceptable tolerances", they are not all exactly the same. So, to get them all to behave the same in the circuit, we have to find the ones whose performance specifications match.

In order to do that, we actually have to measure the performance characteristics of the transistors BEFORE we put them in the circuit of the SG oscillator. Here is a photo and a schematic of the simple circuit that John developed to perform this test.

Essentially, it measures the current passing through the transistor, also called the "collector current" or the "gain" of the transistors.





The tester consists of a 12 volt power supply, a 500ma meter, a place to temporarily connect the transistor, a variable potentiometer to adjust the base current, a momentary switch to activate the test, and two other resistors. In this example, John has taken the front off the meter and added some marks on it so the test is easier to interpret. Regardless of these extra markings, the test results will be on a scale of 0 to 500 milliamps.

From the schematic, you can see that the circuit simply passes current through the transistor to operate the meter. You may find that when testing Bi-polar NPN transistors, you may need to put a jumper wire over the 27K resistor (dotted red line) to get enough sensitivity on the meter. What you are looking for are 7 transistors that pass the same amount of current to the collector when activated by the same amount of current to the base.

In order to do this, you may need to look through (purchase) between 30 and 40 transistors. For hobbyists on a budget, this may be prohibitively expensive. But for serious students who really want to understand how well their SG model can perform, it's a small price to pay. Also, since it is probable that more than one set of matched transistors could come out of a group of 40 transistors tested, experimenters could make group purchases and share the results.

The Transistor Matching Test:

The test is run like this. Once you have the circuit built and the group of transistors you want to test ready, get out a note pad and start testing. Put the first transistor in the tester, push the button to start the test, and adjust the potentiometer to read "mid-scale." The first time through, you are simply looking for the transistor that has the LOWEST gain, meaning the lowest reading on the meter. (You may have to raise or lower the potentiometer in order to find the right range to get the meter to read for all of the transistors.) When you find the transistor with the lowest reading, mark it "Calibration 100". After you have done that, then put that transistor back in the tester and turn the potentiometer so that the meter READS 100. The circuit is now "calibrated" and ready to test your other transistors.

Test each transistor again, but this time, write the meter reading on the transistor in pencil. When you are done testing all of the transistors you have, find all of the ones that have the same number, or numbers that are relatively close to each other. These will become the "matched sets."

If you test 40 transistors, you may be able to put together 2 or 3 matched sets of 7 transistors, with various ranges of gain. The best set will be the 7 transistors that have the highest value with the same gain.

[From now on, leave the calibration transistor with the test circuit. It is part of the test set-up now. This tester is specific for testing MOSFET or NPN Bi-polar Transistors, but you can test any model number within those types. All you have to do is create a specific calibration unit for each different transistor type. This allows you to test a wide variety of transistors and always go back to the settings that are best for each model of transistor.]

Further Refinements:

You may have noticed that we have now discovered which transistors have the same gain when activated by the same base current. After we calibrated the test circuit, each transistor was activated by the same current coming through the potentiometer. In order to get those identical gains to appear in our SG Energizer when it is operating, we need to duplicate that condition, as well.

What that means is, to finish the "fine tuning" process, we still have to find seven base resistors that have identical values. If you absolutely want to max out your fine tuning, you will want to use the single 1K potentiometer and the seven 100 Ohm resistors, one on each transistor base connection, as described in the "basic tuning" section described on pages 8 and 9. If you just want to use fixed resistors, then you want to just use the 470 Ohm resistors that were specified originally.

Luckily, most resistors are inexpensive and come in bags of 200. This gives us plenty of candidates to test. All you'll need for this test is an Ohm Meter (usually part of any digital multi-meter) that can read Ohms down to tenths of an Ohm. When measuring each resistor, standardize the contact method using alligator clips, and write down each resistance. When you have found 7 resistors with the same resistance, you can stop testing.

After you have found 7 matched transistors and 7 matched resistors, you may install them in your model. Your Bedini SG is now "fine tuned."

What is the Most Important?

That depends on your level of interest. If saving money is most important, then just install the 1K potentiometer and any 100 Ohm resistors. This will give you a benefit at a low cost. If you want to see how far the science will go and are willing and able to afford the time and parts, this chapter fully outlines how to optimize the SG oscillator efficiency.

You may be wondering whether using matched sets or faster diodes on the output circuits are necessary? After extensive testing, John has never seen a significant benefit there, but you are always welcome to experiment.

Other Adjustments:

OK, we have tuned the SG Energizer from the electrical stand-point. The last thing to do is tune it from a mechanical stand-point.

The main issues here are maximizing balance and minimizing friction. Right now, the wheel and fan should be fairly well balanced, but you could check that and make any minor adjustments to improve it, if you wish.

The other issue is friction. Since the wheel has an open architecture, there is not a lot of air resistance. The only other friction issue would be in the bearings. If you believe the bearings are stiff because they are either too old or too new, you can take them out of the SG and soak them in kerosene to remove all of the grease. Once they are clean and dry, you can apply a small amount of a light weight oil to them. This should give you a very low friction, free-running bearing.

The last thing you can look at is the height of the magnets above the coil. On page 56 of the Beginner's Handbook, we specified a magnet to coil clearance of 1/8th of an inch. After you have optimized the circuit timing for maximum wheel speed at the lowest current draw from the run battery and are satisfied with the free running of your bearings, you can see if adjusting the height of the wheel above the coil can give you any final improvements. It is the last thing to look at.

Adjusting the wheel height above the coil may have to be done in extremely small increments. For this, a series of shims or spacers is the best method to use. Even if very little benefit is to be expected, you may want to run the experiment just to see the result.

Now that your Bedini SG Energizer is "fine tuned", let's start looking at some advanced theory.

Chapter Two

Energy Conservation
vs
Energy Recycling

The Bedini SG Energizer is a machine that demonstrates an "energy gain" while it runs. This "energy gain" is supposed to be impossible according to the First Law of Thermodynamics and the idea of "Energy Conservation." The First Law of Thermodynamics is usually expressed with the idea that "Energy can be converted from one form to another, but it can not be created or destroyed."

This idea was initially derived from a paper titled ***On the Conservation of Force***, published in 1847, by Hermann von Helmholtz. But this is a significant departure from what he really said. His original statement was "Nature as a whole possesses a store of energy which cannot in any wise be added to or subtracted from", to which I would simply add "by us".

But I would go farther. I would also say that "Nature as a whole possesses the entire store of energy by which any of our machines may be activated, regardless of how well they may convert that energy into a useful form."

We have never said that the Bedini SG Energizer "creates" energy. We have said, however, that it operates in an "open relationship" with the immediate environment. This allows the machine to gather energy from the environment at a rate that more than makes up for any energy that may be dissipated back into the environment at the same time.

Energy Conservation states that "energy cannot be created or destroyed." This, however, does not preclude the idea that this same indestructible energy may be able to be recycled or reused! The general interpretation presumes that this cannot be done, but, in fact, it can.

Nikola Tesla was one of the first significant scientists to turn his back on the Laws of Thermodynamics and publicly state his disbelief in these ideas. He openly proposed "heat engines" that derived all of their energy from the ambient heat of the air while producing cold air as a by-product. His replication of Heinrich Hertz' experiments concerning the propagation of electromagnetic waves in air caused him to denounce the entire "discovery" as completely false. He even referred to the mathematical work of James Clerk-Maxwell as "poetical concepts." By 1900, Tesla had run enough experiments that he was certain that electrical phenomena did not follow the same laws as heat in almost every situation.

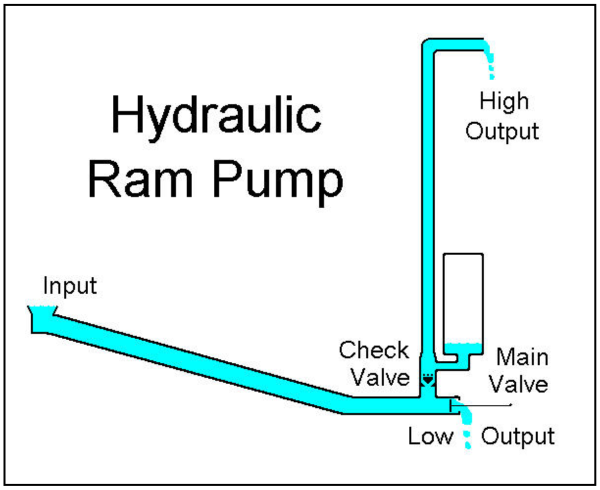
Tesla saw no reason to associate thermodynamics with electrodynamics at all. In fact, he thought electrodynamics was much more related to fluid dynamics. In his June 1900 article titled ***The Problems of Increasing Human Energy***, Tesla states "Whatever electricity may be, it is a fact that it behaves like an incompressible fluid and the earth may be looked upon as an immense reservoir of electricity."

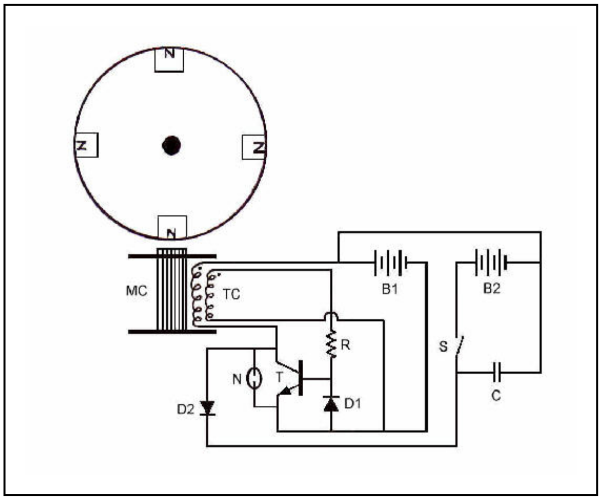
While Helmholtz was brilliant, and we owe a great debt of gratitude to him for his discoveries, his philosophical attempt to unify all forms of energy into a single set of behavioral laws in 1847 was premature, and ultimately, incorrect.

So, what is really going on? What methods allow us to use electricity, recaptured it, recycled it, and use it again? Its really quite simple. Since electricity becomes useful when a potential difference is present, the "trick" to recycling it is to get electricity to raise it's own potential!

In thermodynamics, it is difficult to get heat to raise it's own temperature, but in fluid dynamics, it is quite easy to get a low potential flow of water to pump itself to a higher level by taking advantage of its inertia. The best known method to do this involves the use of a device called a hydraulic ram pump.

The following illustrations highlight a number of similarities between the hydraulic ram pump and the Bedini SG oscillator.





The hydraulic ram pump is a simple device that allows the inertia of a FLOW of water to pump some of that water to a higher level. Here's how it works. Water flows from the Input to the Low Output through the Main Valve. This flow builds up a momentum in the mass of the water. So, when the main Valve is suddenly shut, the water has nowhere to go but past the Check Valve, up the Rise Pipe, and out the High Output. When the pressure and momentum of the water flow is exhausted, the Check Valve closes, the Main Valve opens, and the cycle begins again.

The Bedini SG oscillator is remarkably similar. Battery B1 establishes a flow of electricity through the Main Coil MC when transistor T is conducting. This builds up an inertial momentum in the circuit that establishes itself as the magnetic field in Main Coil MC. When the transistor T suddenly stops conducting, the magnetic field established by the current flow wants to keep that current flowing. This represents an inertial property of electricity, like stored momentum. Since the current continues to flow, but cannot flow in the loop with battery B1, it is forced out through diode D2 and will raise it's potential as high as it needs to to fully exhaust the momentum.

So, the gravity fed water flow from Input to Low Output in the ram pump is like the Input to the oscillator from battery B1. The inertial properties of the water flow are like the magnetic field in Main Coil MC. The Main Valve in the ram pump is like the transistor T in the SG oscillator. The Check Valve in the ram pump is like diode D2 in the oscillator. The High Output of the ram pump is like battery B2 being charged to levels above battery B1 in the SG circuit.

This illustrates how a hydraulic ram pump is almost a perfect analogy for the Bedini SG circuit. Tesla was right. The behavior of electricity closely follows the model of fluid dynamics, not Thermodynamics. In addition to this, the method to get electricity to "raise it's own potential" by eliciting its inertial properties has been known for over 100 years!

If you question these ideas or someone else questions you about this, don't be intimidated. The Bedini SG Energizer does NOT follow thermodynamic models and its behavior is not limited by modern interpretations of these rules. The SG does use and recapture much of the energy it is running on, and then goes on to recycle it again for future use in the second battery.

Tesla discovered these processes while trying to replicate Hertz's supposed findings of electromagnetic waves. He first reported on these discoveries in a lecture titled ***On Light and Other High Frequency Phenomena*** in February of 1893. (120 years ago!) This lecture outlines what Tesla spent the rest of his life working on. It is also the first public disclosure of his discovery of a new way to use electricity.

This process he called his "Method of Conversion."

Chapter Three

Tesla's "Method of Conversion"

On May 1, 1888, Nikola Tesla was granted seven US Patents. These patents covered his single phase and multi-phase electric motors, generators, transformers, and the methods to transmit electric power over long distances with minimal losses. Five other US Patents were issued to him that year that helped round out the new way to use poly-phase, alternating current (AC) electricity at an industrial scale.

In 1896, these inventions and methods became the basis for the first large-scale hydro-electric power station to be built at Niagara Falls with the power used to light up Buffalo, New York, and eventually, New York City, over 400 miles away. Most inventors would be proud of such an accomplishment, but for Tesla, there was a problem. Between 1888 and 1896, he had developed a better way to use and transmit electric power!

He first publicly described these new methods of energy production and energy transmission in a lecture titled ***On Light and Other High Frequency Phenomena***, delivered twice, first in February 1893 in Philadelphia, and second, in March in St. Louis. In this lecture, he openly declared that he had discovered a whole new way to use electricity and a way to "convert" ordinary electricity into this new type.

These discoveries proved to Tesla that static electricity was more powerful than electro-magnetic force; that interrupted direct currents were more important than alternating currents; that electric current could be propagated down a single wire with no return; and that loads could be operated at the end of a transmission line that reflected little or no energy consumption effects back to the generator.

This was definitely a better way to use electricity! The process to produce these effects from ordinary electricity he simply called his….

"Method of Conversion."

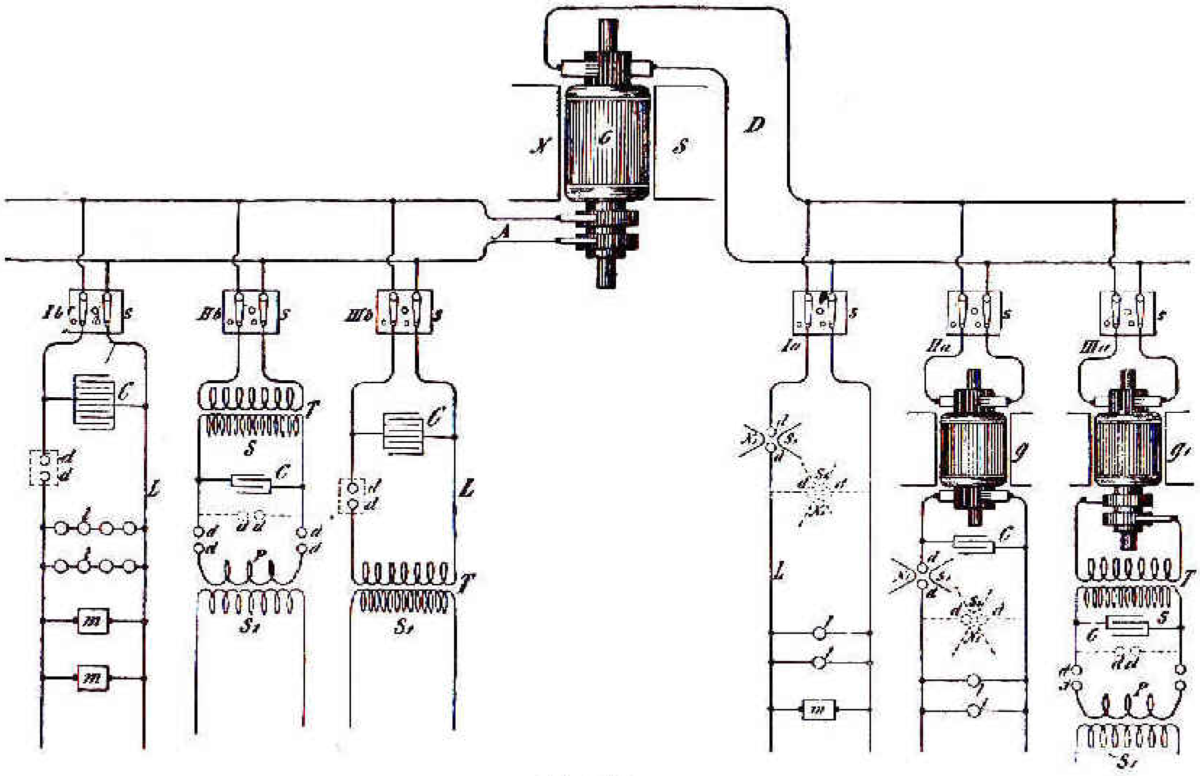
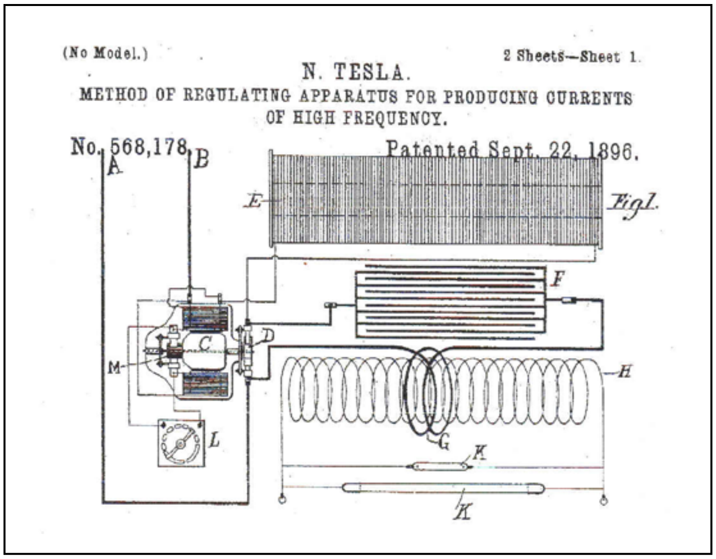


Fig. 165.

This diagram, taken from Tesla's lecture, shows the six most effective ways to produce the effects he discovered. He clearly shows that the effects can be produced whether he started with AC (3 examples on the left) or DC (3 examples on the right). [Mind you, these are circuits for the methods that worked the best in 1893. Modern circuits open up new possibilities.]

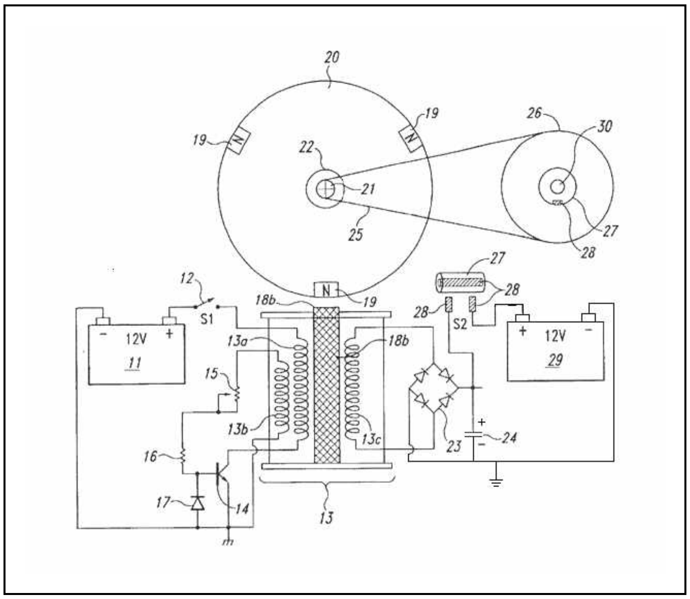
He also developed solid-state methods to produce these effects. The best example of this type of circuit is found in US Patent #568,178 issued in September of 1896. The circuit charges an inductor with interrupted DC currents, then discharges the inductor to charge a capacitor, which in turn discharges into a low impedance circuit to produce the effects he wanted.

The patent states: "The energy of the direct current supply is periodically directed into and stored in a circuit of relatively high self-induction, and in such form is employed to charge a condenser or circuit of capacity, which in turn, is caused to discharge through a circuit of low self-induction .. for producing any desired effect." Tesla used this circuit to step the voltage up from the capacitor discharge to power special lights designed to run on these currents, as shown in the image above.



This illustration also shows a small electric motor operating a rotating switch to control the capacitor discharges.

Here, again, is the illustration of the SG circuit from John's US Patent. The circuit charges an inductor (coil) from an interrupted DC source, discharges the coil into a capacitor, which in turn is discharged periodically into a low impedance load (battery).



The similarities are obvious. The SG circuitry looks like a modern version of Tesla's Method of Conversion. It is simply designed to operate on lower voltages and with modern components. Besides that, it performs many of the same circuit functions and provides many of the same benefits.

What does the Circuit Do?

The output of Tesla's circuits operated the loads on a rapid series of capacitor discharges. These were bursts of voltage and current, all propagating in the same direction, separated by intervals of no activity. Tesla said that running circuits on this type of power "..enables me to produce many effects which are not producible with an unvarying force."

What he is saying is that a staccato of uni-directional impulses can accomplish things that pure DC (direct current) cannot. So, let's look at this situation and analyze what is happening.

A relatively low voltage, low current source of DC can be used to charge the inductor (coil) in the first step. When the coil discharges into the capacitor, depending on its capacitance, the voltage may rise to many times the voltage of the original source. So, in step two, the voltage rises, which for Tesla represents the "electrostatic force." Voltage is the equivalent of pressure in a fluid, so in step two, the electrical pressure has been raised.

Now, when the capacitor is discharged into a circuit of low impedance, all of the energy can discharge very quickly. This means that for a very short time, there is a very high flow of current. So, the total effect of the circuit is to take a moderate but continuous flow of voltage and current and convert it into a series of short impulses of high voltage at high current.

What are the Benefits?

In order to get a clear idea of the benefits of this conversion, I offer this illustration. Imagine, if you will, a wall made of a typical wooden frame covered by sheet rock (plaster board). My goal is to tear down the wall, but all I have is the energy equivalent of "one pound of force" distributed over "one square foot" of the wall. I can provide this amount of energy continuously, but applied to the wall directly in its present form, I cannot move the wall or even scratch the paint. How can I use this amount of energy to destroy the wall?

Tesla's Method of Conversion is the way. So, in the first step, I need to raise the pressure of the energy manifestation. I can do that by taking the one pound of force distributed over the one square foot (144 square inches) and apply that force across a smaller area. Let's say I cut the area down to ¼ the size. So now I am applying my force across an area that is 6 inches by 6 inches, or 36 square inches. For the amount of energy to be the same, I am now applying 4 pounds of force across 36 square inches of the wall.

This is great, but it's not enough, so I cut the area down by ¼ again. Now I am down to an area that is 3 inches by 3 inches with a force of 16 pounds applied to it. So, I have raised the pressure (force) in the situation by 16 times by applying the energy to a smaller cross-section of the wall. But this is only step one in Tesla's Method.

Step two is to make the force intermittent. OK, I currently have 16 pounds of force continuously applied to 9 square inches of the wall. What happens if I apply all of that force in 1/10th the time? Now I can hit the wall with 160 pounds of force for a 10th of a second. Now that is going to start smashing the plaster board. Mind you, we are still talking about exactly the same amount of energy as we started with.

Step three of Tesla's Method allows us to create a series of these large impulses, second after second. So, we can hit the wall with one 160 pound impulse for a 10th of a second, once a second. Alternately, we can hit the wall with 160 pounds for a 100th of a second, ten times a second, or for 1000th of a second 100 times a second. As I can continue to do this, second after second, the wall is rapidly demolished.

So, what has changed? Think about it. It's important that you understand this. The total amount of energy expended has not increased. There is NO energy gain here. But what we have done is to concentrate that energy and change the density and time constant of its expression.

Energy is defined as the ability to do "work" and the rate at which work is delivered over time is called "power." So, one of the things Tesla's Method of Conversion produces is a "power gain." It can convert a source of low voltage and low current electricity into a series of uni-directional electrical impulses of high voltage and high current. Tesla stated that this process was able to produce effects that could not be replicated any other way.

Even alternating currents of high voltage and high current could not do what the uni-directional impulses could. Upon careful analysis, the reason is clear. Alternating currents do not transfer any net inertial effects since all momentum produced in one direction is negated by the next reversal. Thus, the inertial properties of electricity cannot be expressed using alternating currents or continuous direct currents. Only intermittent direct current impulses allow the expression of electrical inertia to build up in a system; like a hidden flywheel storing momentum. This is another added advantage of the process.

Yet another advantage of the process has to do with the electrical characteristics of capacitors designed for rapid discharge. The property is called a "low ESR", or equivalent series resistance. The capacitor offers almost no resistance to the discharge of high currents. In AC systems, this is referred to as "low impedance."

Many of you may know, when the source impedance of a power supply is lower than the connected load, the rate of power transfer can be very high. John Bedini found this to be especially useful when applied to battery charging. The inertial effects of the electrical impulses would build up in the battery, and even continue to charge the battery after the charger was disconnected! John eventually referred to this process as "over-potentializing the electrolyte."

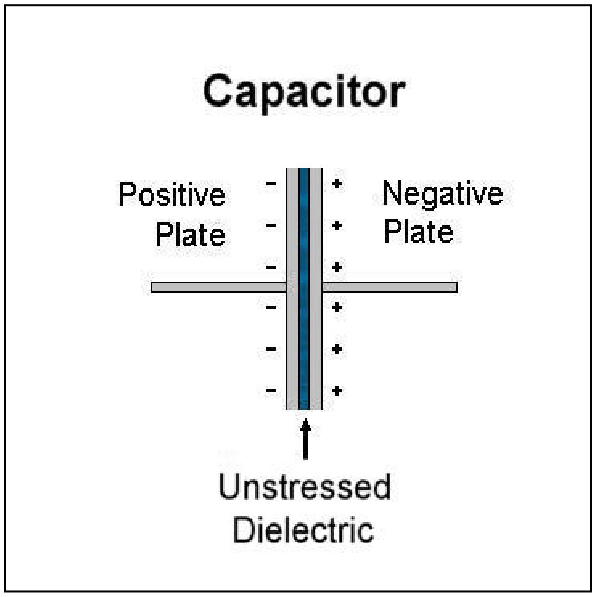
There are even more advantages that show up when Tesla's Method of Conversion" is fully explored. To do this, let's look closer at the capacitor and see what happens when it is charged by a collapsing inductor.

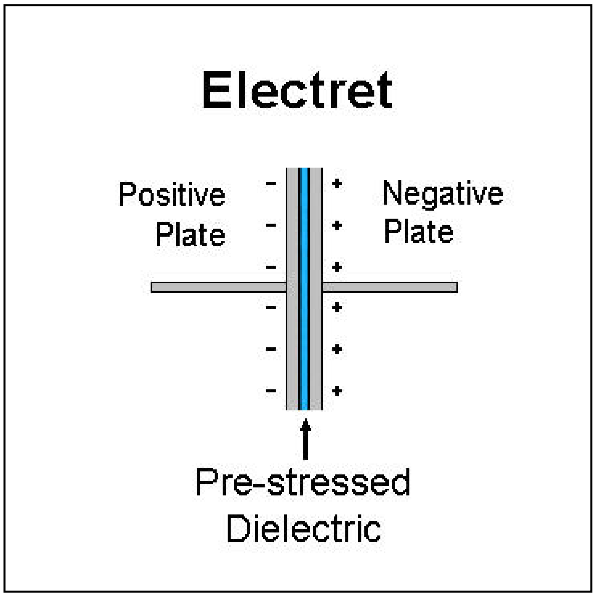
Chapter Four

Capacitors and Electrets

Capacitors are electrical devices that can "store" electricity. This is the general understanding. The specific issues concerning "how capacitors work" and "how electricity is stored in them" are extremely complex. Questions of whether that charge is stored as electrons on the plates or as a stress in the dielectric separator are still being debated in professional circles.

But before we explore that, we need to understand the function of another electrical device called an electret. An electret is similar in construction to a capacitor in that it has two electrically conductive plates separate by a dielectric material. But in the case of an electret, the dielectric material is permanently polarized, so it spontaneously produces a charge separation. An electret is like the static electricity analog of the permanent magnet. A permanent magnet constantly produces a polarized magnetic field around itself, and an electret constantly produces a polarized electric field within itself.





The simplest way to make an electret is to pour hot, molten wax in between two metal plates and establish a high voltage gradient across the plates. As the wax cools and hardens, its crystal structure forms in the stress of the electric field. After the wax cools down to room temperature, the two metal plates will always have a voltage potential between them. The best kinds of wax for making electrets are bees wax and carnauba wax.

What is interesting about this is that Nikola Tesla routinely used paper impregnated with bees wax as the dielectric separators in his capacitors. This arrangement always made his oscillators produce higher outputs.

John Bedini has used commercially available "electrolytic" capacitors in his oscillator circuits, but has found corresponding gains, even at much lower voltages and much lower frequencies than Tesla employed. It has taken considerable work to figure this all out, but what seems to be happening is this.

Temporary Electrets:

When an appropriate dielectric material is used in a capacitor that is charged from the energy of an inductive collapse, the electrostatic component of this type of electricity produces a "temporary electret effect" in the capacitor. Exactly how well this effect is established and how long it persists depends on the material used as the dielectric.

Here is what it looks like. Normally, if you charge a DC capacitor from a battery or from a rectified power supply, the capacitor will charge to the applied voltage. After the supply is removed, the capacitor can be discharged once and drawn down to 0.00 volts. After the load is removed, the voltage on the capacitor may rise above 0.00 volts by a few millivolts. The standard behavior of a capacitor involves very little voltage recovery.

If, however, that same capacitor is charged by an inductive collapse event and subsequently discharged to 0.00 volts, as soon as the load is removed the voltage may rise back to as much as one VOLT! This behavior of ordinary electrolytic capacitors has been witnessed thousands of times. As this process is repeated during operation of the SG oscillator, the effect eventually reaches a maximum level. Whatever that benefit level is, this is the second method employed by John in the SG Energizer to get electricity to "raise it's own potential."

What this means is that every time we discharge the capacitor into the battery to charge it, the capacitor is refilled, partially from the coil discharges, and partially from the "temporary electret effect" in the capacitor itself. This phenomena is definitely an energy gain in the system and the appearance of electricity that did not come from the run battery in any way that can be measured on today's meters.

This clearly establishes the theoretical basis for the observed performance of the machine. The second battery charges better and faster when the capacitor charge and discharge section is added to the circuit, in spite of the measurable losses associated with the switching process.

All of the charge rebound that the capacitor provides on its own is completely free, as it is not provided by the first battery in any known way. This gives an immediate and obvious advantage over charging the battery directly with the coil discharges.

So, in spite of the energy losses that are measurable in the switches, and even the charge losses caused by capacitor "leakage", the "temporary electret effect" seems to be able to more than off-set these losses with an even larger gain in charge.

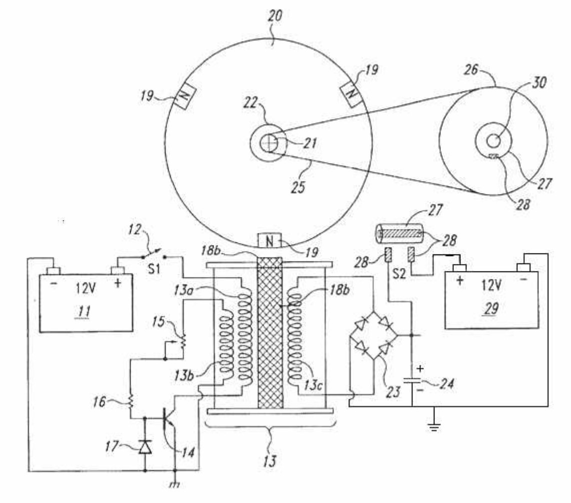
OK, let's look at this process more closely.

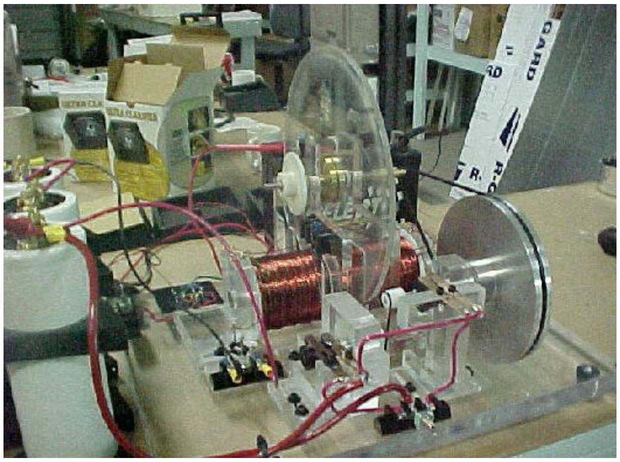
Chapter Five

Capacitor Charge and Discharge Methods

Over the last 8 years, a great deal of information about capacitor discharge methods for the SG circuits have been discussed on the Internet. In order to remove as much confusion as possible from this presentation of the material, a brief review of these ideas will be helpful.

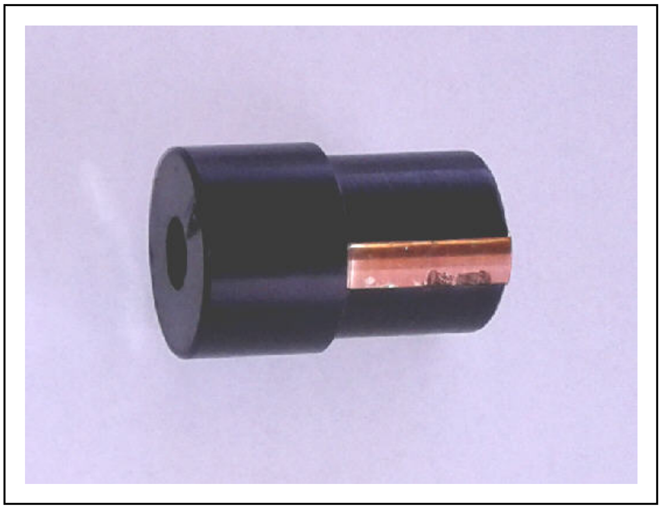
The Beginning:

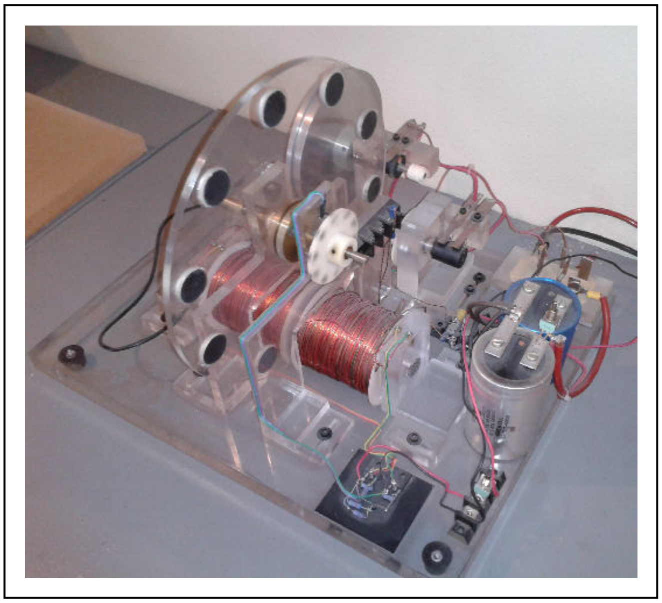




All methods of capacitor charging and discharging stem from John's original patent diagram, shown here. It shows a capacitor (#24) being charged by an isolated output winding (#13c) through a full-wave bridge rectifier (#23). The capacitor is then discharged through a rotating commutator and brush mechanism that makes and breaks the POSITIVE wire connection between the capacitor and the battery.

One variation of this machine ran continuously for over 10 weeks straight during the winter of 2002. The capacitor was 330,000uf charged to 3 volts above the battery and discharged about once per second. The brushes had silver contacts and the commutator wheel consisted of a section of copper rod inserted into a Delrin wheel, with the wheel machined down to expose the copper, as shown here in this close-up photo. The Delrin made the brush friction very low, and the silver/copper combination made the contact resistance very low. The wire in the capacitor discharge path was 8 gauge, also to keep the electrical resistance low.





The SG wheel was turned in the "forced repulsion mode" operated by the "Bedini-Cole Switch" on the black heat sink in the lower foreground. Even though I explained in the first book that the "self-triggered" system operating in the "attraction mode" is more efficient, this early unit was still able to "self run" for more than 10 weeks by trading front and back batteries about once every 12 hours.

The point is this. There are multiple ways to make this work, but every system I have seen "self run" had a capacitor discharge circuit charging the batteries.

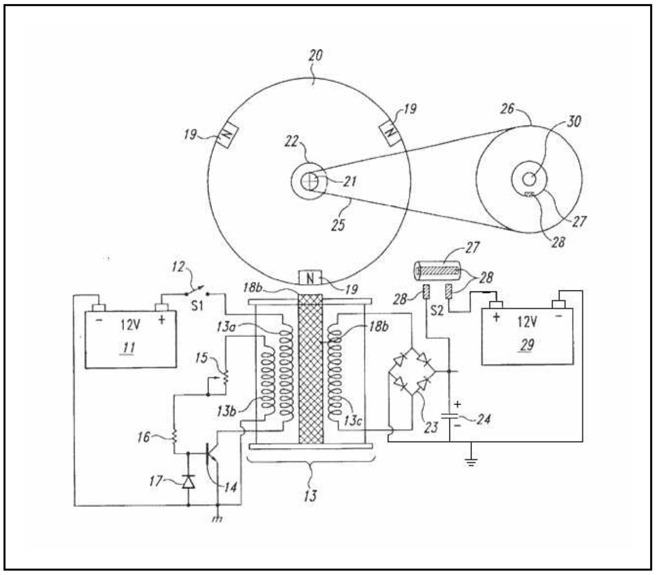
So, let's recap this design. It has an isolated winding in the output. It has a full-wave bridge rectifier between the coil and the capacitor. The discharge circuit makes and breaks the positive line between the capacitor and the battery. Contact for the discharge is made with a rotating commutator and brush mechanism. Large diameter wire is used in the discharge path to keep electrical resistance down. The capacitor is relatively large (330,000uf) and the discharge rate is about once per second.

This example clearly defines the five major components needed for charging and discharging the capacitor. They are:

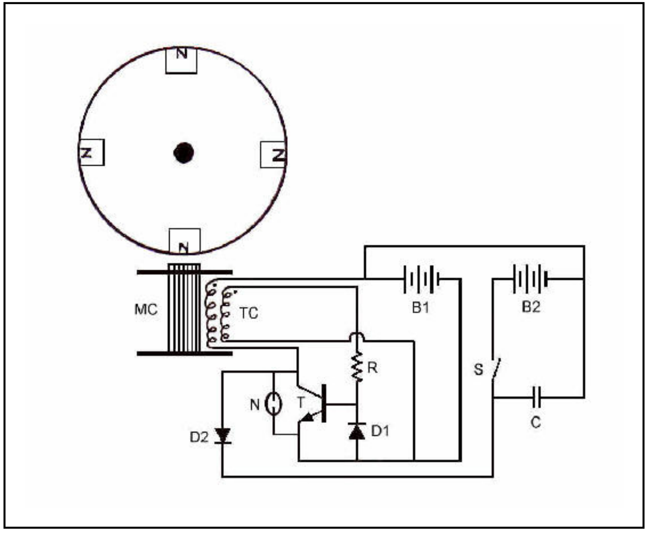
1. The circuit used to take the energy out of the coil and transfer it to the capacitor.
2. The circuit used to take the energy out of the capacitor and transfer it to the battery.
3. The method of switching used to discharge the capacitor.
4. The method of timing used to trigger the switching mechanism.
5. The size of the capacitor and the frequency of its discharge.

John has tried at least 300 variations on all of these parameters and has come to a set of specifications he uses regularly now. Over the years, many people in the forums experimented with dozens of these ideas, so it is difficult to find the best way to do this from that source. To clarify the best way to accomplish each of these, I'd like to expand on them a little bit.

Circuits for Charging the Capacitor:



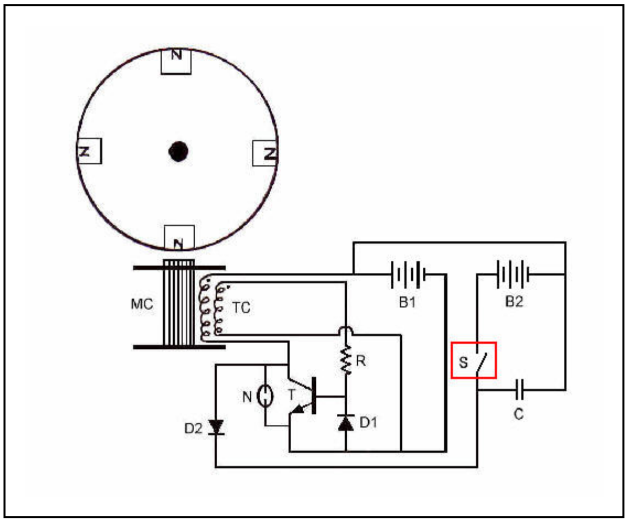
The drawing to the right shows the circuit that charges the capacitor (#24) from an isolated output winding (#13c) through a full-wave bridge rectifier (#23). From an electrical efficiency point of view, this is the least efficient method. The full-wave bridge requires the output pulse to travel through two diodes that each have a voltage drop of about .6 volts. Second, having the output pulse produced on a coil winding that is different than the winding the pulse came into the coil on, also produces about a 2% loss by induction.



So, it seems clear that collecting the output pulse from the main coil winding (MC) and using a single diode (D2) to direct that impulse to the capacitor (C) is more efficient.

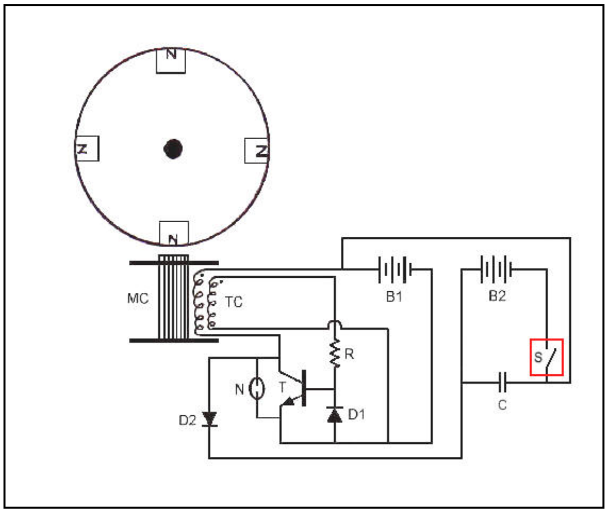
If the goal is to charge the capacitor and discharge it into a second battery, as shown, there are very few reasons not to use the second method. If your goal is to recover this energy and make it available to off-set the drain from the first battery, then collecting it off of an isolated winding makes this task much easier. (Sample circuit not shown) But since the output pulse is inherently DC in nature, there is rarely a need to use the full-wave bridge at anytime, since a single diode is sufficient to isolate the pulse and store it in the capacitor.

Circuits for Discharging the Capacitor:



From the very early diagrams to the drawings used in the Beginner's Handbook, we have always shown the capacitor discharge circuit with the switch on the POSITIVE line. Classical electric circuit theory usually leaves the negative or ground lines connected throughout the circuit, and this is where John began his experiments, as well.

However, when John started to seriously explore the capacitor discharge effects on the battery, he found that leaving the positive lines connected and switching the NEGATIVE line also had merit. After extensive testing, John now switches the NEGATIVE line almost all of the time.



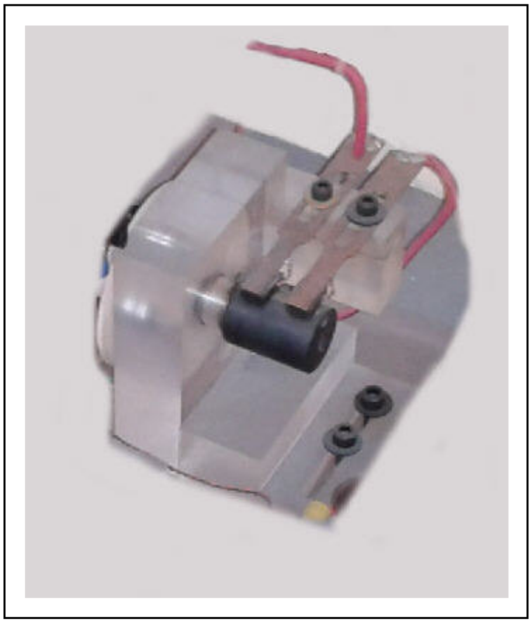
The new theory that supports this thinking suggests that allowing the high voltage pulses coming from the coil to build up on the capacitor, but also letting them act on the positive terminal of the battery, produces a better result. The theory is that this circuit allows the positive plate of the battery to become "pre-potentialized" even before the current surge released by the switch acts on the chemistry.

Switching both the Positive and the Negative connections between the capacitor and the battery at the same time may also have merit, but this option has not been extensively explored yet. This would provide complete isolation between the capacitor and the battery and may have uses under special conditions.

Methods of Switching:

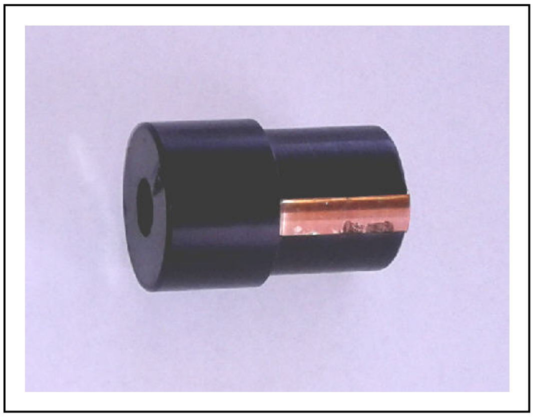
We have discussed the capacitor discharge circuits. Now we are going to discuss the various ways that are available to make and break the circuit. In general, there are three basic ways to do this. They include mechanical methods, electronic methods, and hybrid methods that use features of both.

The mechanical methods generally use a brush style commutator like the ones shown previously, or a cam actuated mechanical switch. The electronic methods generally use either bi-polar transistors, MOSFETs, or SCRs. The hybrid methods may use a cam actuated switch to trigger a transistor or other device. You can see, there are lots of options here. So let's look at each of these in more detail.

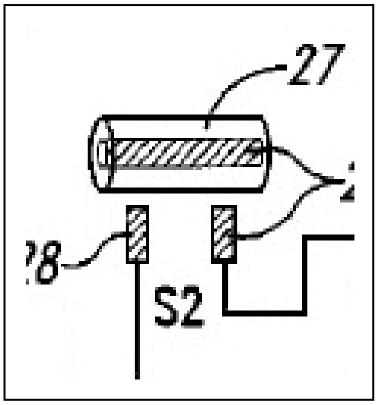


Mechanical Methods:

So, again, here is a picture of the basic mechanical switch used by John in many of the early models. The black wheel is turned at a mechanically reduced rate from the main Energizer Wheel. It is made of Delrin with a copper bar inserted into it. Then both are turned down in a Lathe to expose a small section of the copper.



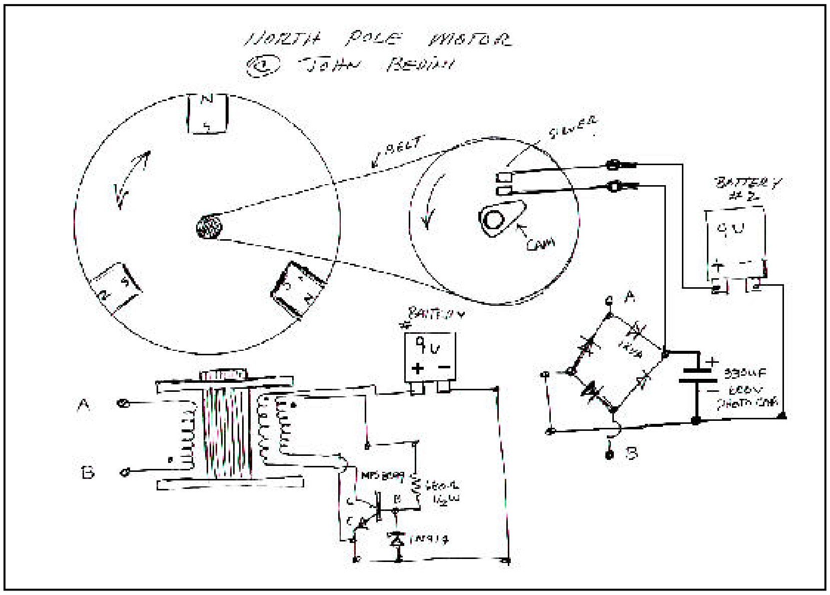
Both brushes contact the surface of the Delrin and when the copper section comes around, a contact is made between the brushes. This creates an electrical connection between the capacitor and the battery, and so the energy charge in the capacitor discharges into the battery.



There are advantages and disadvantages to this method. The main benefit is that it is mechanical, so it can be built with no knowledge of complex electronic circuits. It does require some special tools, like a lathe, but industrious individuals can probably figure out how to built a rotating switch similar to this with basic tools.

One disadvantage can be seen in the middle photo. You should be able to see that the copper is "pitted" along the lower edge. This represents the first edge to contact the brushes where the initial current surges from the capacitor discharges are melting away the copper. So, there is some physical degradation of the switch and a maintenance issue over time.

The other main disadvantage is that the brushes make contact with the switch for a much longer time than is required to discharge the capacitor down to the voltage of the battery, since the capacitor cannot begin to charge up again until the switch disengages.



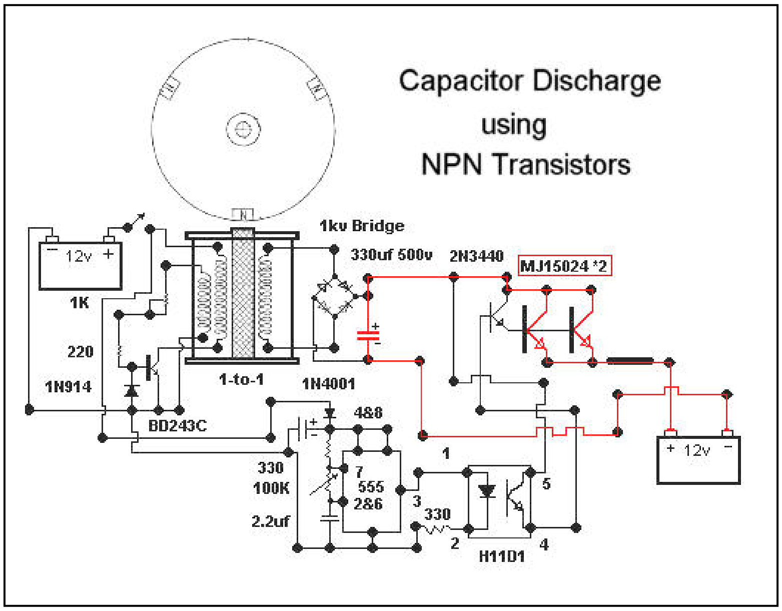
The other method to discharge the capacitor with a mechanical switch uses a small "cam" mechanism on the shaft of a geared down wheel, and the cam is used to actuate a stationary, enclosed momentary contact switch.

This type of switch, pictured here, is readily available from many commercial outlets. Many of them come with their own "roller" attached to the actuator arm that is also spring loaded to turn itself OFF again after the cam passes.

This method can be easily built by beginners who do not have access to machine tools, such as lathes or milling machines.

Electronic Methods:

The electronic methods to discharge the capacitors are much more complicated. Most of them use similar circuitry to control the device that actually does the switching.



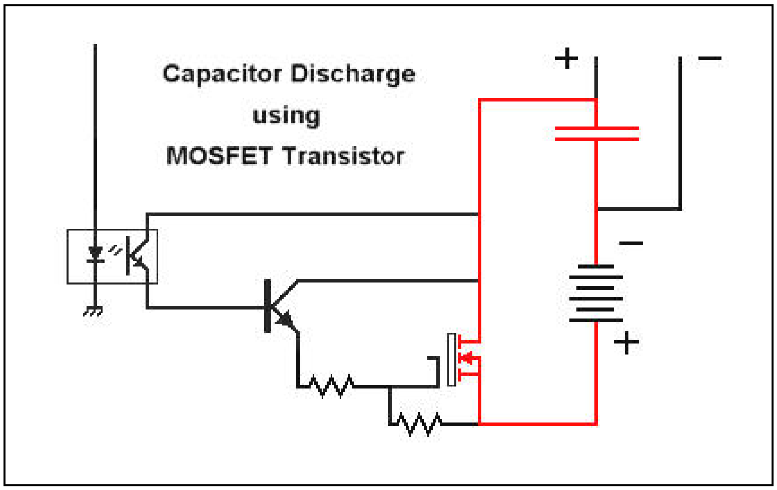
Here is an example of a circuit that has been posted on the discussion threads for many years. I have highlighted in RED that part of the circuit that actually allows the discharge from the capacitor to the battery.

You can see that the circuit also includes a timer chip (555), as well as an opto-isolator chip (H11D1) and a smaller NPN transistor (2N3440) to turn ON the main transistors (MJ15024).

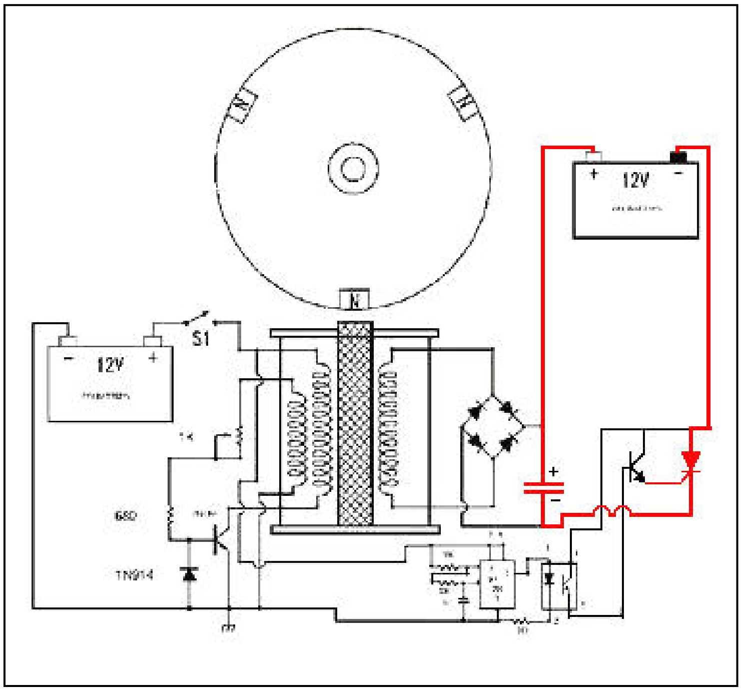
This is very close to the circuit used in the small unit pictured here called "The Real McCoy". The small yellow capacitors, with a total of 6.6uf, were charged to about 100 volts and discharged about once a second. It could charge any type of battery from 2 volts to 24 volts.

Since the unit was completely enclosed in this old bulk CD case, it had to "self-start" when connected to power. For this reason, it used the forced repulsion drive mode and the "Bedini-Cole switch" to control the oscillator.

Here is an example of a circuit to discharge the capacitor using a MOSFET transistor. The discharge circuit path is traced in RED. The section of the circuit that charges the capacitor comes from the (+) and (-) terminals in the upper right corner. The signal that controls the discharge timing comes from the upper left corner, also not shown. These features could be the same as shown in the diagram illustrating the NPN Transistor circuit on the previous page.



Finally, here is an example of a capacitor discharge circuit using an SCR. The discharge circuit path is traced in RED. Again, John has used a 555 timer chip, an opto-isolator, and another small transistor to trigger the SCR, like he used for the MOSFET and the power NPN Transistor.

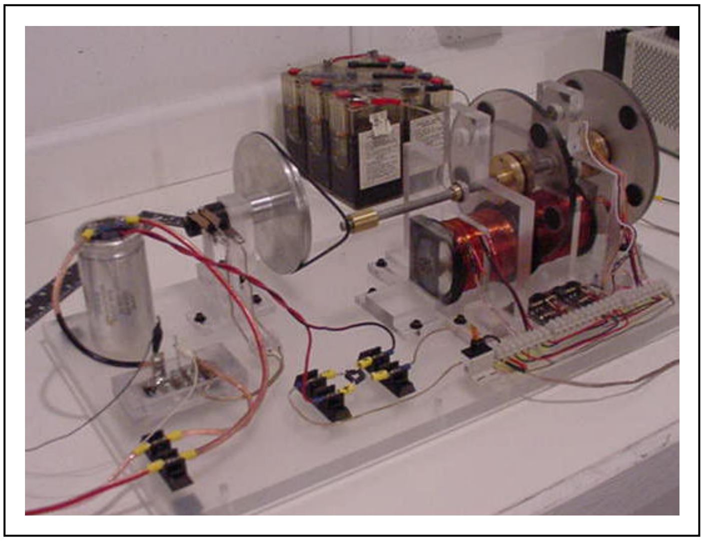


The first two transistor circuits show the Positive line being switched while the third one, the SCR circuit, shows the Negative line being switched. The point is, the methods to switch either line are very similar.

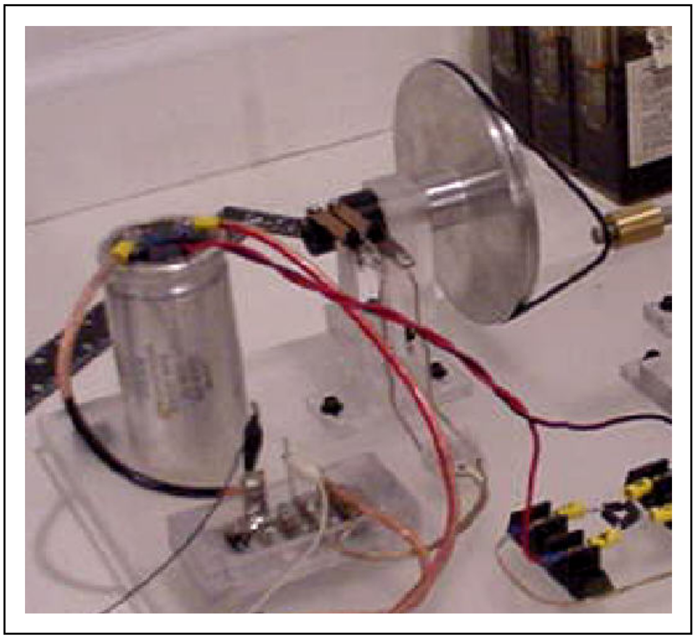
The pros and cons of each of these devices are as follows. The NPN transistor has the highest voltage drop across its junction, so it is better in systems where the capacitor is charged to higher voltages. The SCR has the lowest voltage drop across it's junction, but once activated, it will not turn

OFF until the voltages equalize between the capacitor and the battery. The MOSFET has a middle value voltage drop across its junction, about half way between the NPN and the SCR. But it can be turned ON and OFF at will, like the NPN. For these reasons, the MOSFET is usually the device chosen for these systems, as long as the voltages in the capacitor are in the moderate range, which means less than 20 volts above the battery.

Hybrid Methods:



These methods of discharging the capacitor use features of both mechanical switching and electronic switching together. In this picture, you can see the belt driven speed reduction feature, similar to the one shown on page 28.



That is operating the rotating brush switch, which in turn triggers the transistors shown in the plastic box in the lower center of the second picture. The switching of the transistor then discharges the capacitor to charge the battery.

So, this illustrates the three main ways to discharge the capacitor into the battery. As you can see, many dozens of different methods have been devised and tested over the years. Working closely with John during this period of development, I was constantly confronted with "John's Method".

That is, he was never satisfied when an experiment worked, even if it worked extremely well. He was always looking beyond the moment, to see what was still possible. And….he never guessed! He would always built it, and run the test!

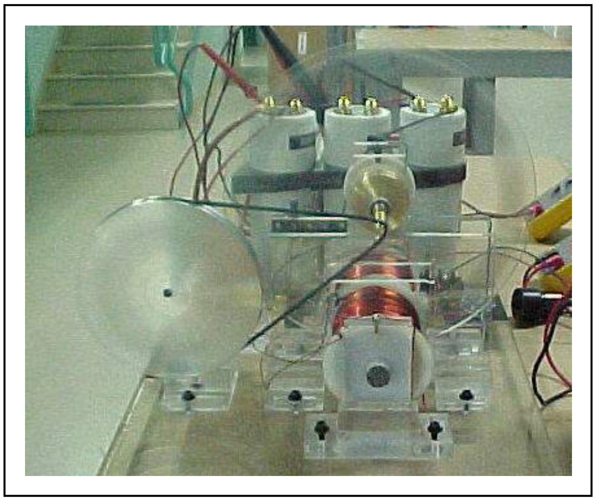
At one point, John was testing different control circuits to trigger the discharge and he built and tested over 30 variations of a circuit in about two weeks. This photo shows a sample of some of those test circuits, still in the box and stored on a shelf in his shop. He also never threw anything away, and never scavenged one experiment to build a newer one. Everyone of the circuit boards in this box still works!

For John, it was always about the learning and the path of discovery. It was never about getting a "self-running machine", primarily because he had done that in 1984 and many other times since then. He was looking for specific, incremental gains that he could add to his already vast knowledge base.

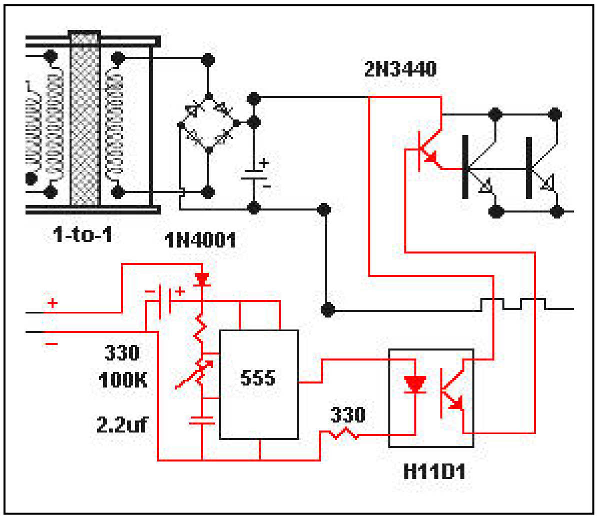
Back in his 20's, John worked for TRW, a manufacturer of semi-conductor devices. There he learned that any kind of device, like a MOSFET or an SCR, can be operated outside of its normally considered specifications, if you know how to safely push it there. Because of this, John can get circuits to do things that other electronic circuit designers cannot. So, for instance, when John refers to using "inverted circuits", he is generally referring to using one or more components in the circuit in a way that is either different or even completely opposite of the standard method of use.

As an example, John has devised ways to turn SCRs ON and OFF at will, even when the voltages across the junctions never equalize. In standard practice, this cannot be done, and most circuit designers do not know how to accomplish this. But John knows how and has used this method in a wide variety of circuits.

Methods of Timing:



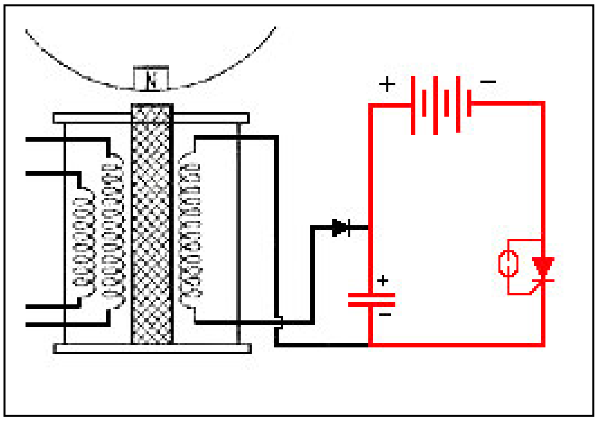
The simplest timing methods are the mechanical ones. Here we see an end view of one of the early units. The "gear reduction" ratio on this belt drive is at least 20-to-1, so the main rotor turns 20 revolutions for every time the timing wheel turns once. With 10 magnets on the wheel, it means that 200 pulses charge the capacitor before the brush mechanism discharges it into the battery.



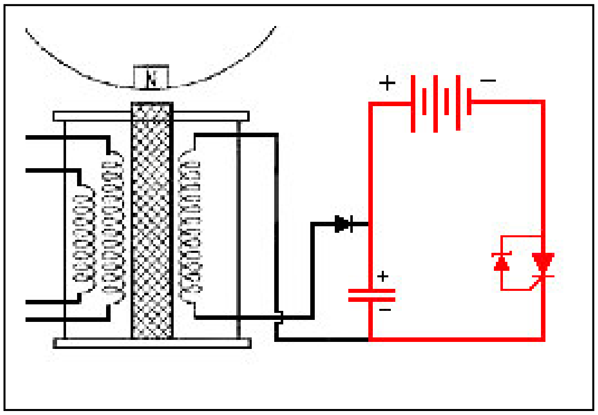
The next method to control the timing is the purely electronic method. Here is a blow-up of the Timing Section of the circuit from the diagram on page 35. It shows power (12 volts) coming in from the Run Battery on the left (+ and -). This powers a 555 timer chip configured to produce an impulse between .2 and 20 times per second, selectable on the 100K trim pot. The output of the 555 powers the LED section of the H11D1 Opto-Isolator chip. This chip allows the timer, which is powered by the input battery, to control the discharge of the capacitor, which has no connection to the input battery. The output of the H11D1 chip then controls the triggering of the 2N3440 transistor, which in turn, controls the primary device used to discharge the capacitor.

Again, the kinds of devices that can be used to discharge the capacitor can include NPN transistors, PNP transistors, MOSFETs, SCRs or even Triacs.

The third method of controlling the timing of the capacitor discharge uses a circuit that can sense (measure) the voltage building up in the capacitor, and discharge it when that voltage reaches a predetermined level. These "automatic" methods of triggering the capacitor discharge range from simple to complex. One simple method is illustrated here, where a neon bulb is used to trigger an SCR when the voltage in the capacitor rises to about 100 volts. This method works really well for about 20 hours, after which the neon bulb "polarizes" and stops firing. This was the first method John experimented with in 2003.



Other simple methods involve using an SCR triggered by a Zener diode or a Zener diode triggering a small transistor which triggers the SCR. The value of the Zener diode will determine how high the voltage in the capacitor will rise above the battery before it discharges.



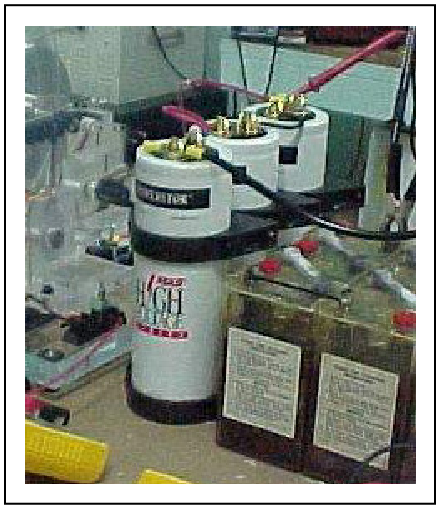
These SCR circuits only work when the capacitor is charged by periodic pulses, like the output of the Bedini SG, as the SCR may never latch closed again if the capacitor is charged by a continuous current method.

Other, more sophisticated circuits can use a combination of Zener diodes, OP-AMP chips, and voltage regulators to monitor the voltage of the capacitor and automatically regulate its discharge. John has developed excellent circuits that work on this principle. You may wish to purchase one of his "ready built" capacitor discharge circuits for the SG Energizer Kits, or develop your own. These kinds of circuits are great because they can automatically adjust to a faster discharge rate as you increase the charge rate of the capacitor.

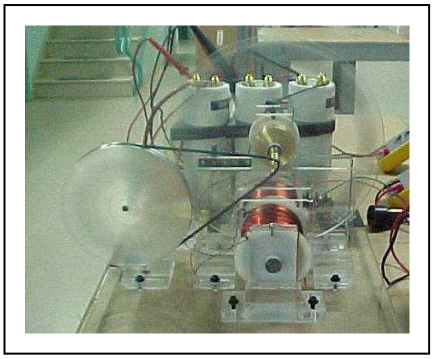
Capacitor Characteristics:

Capacitors are one of the most varied electronic components available today. They can be used for dozens of purposes, including filtering high frequency noise, storing charge for later use, creating phase shifts in AC circuits, helping to start AC electric motors, producing resonant oscillations, as well as facilitating the production of instantaneous transients.

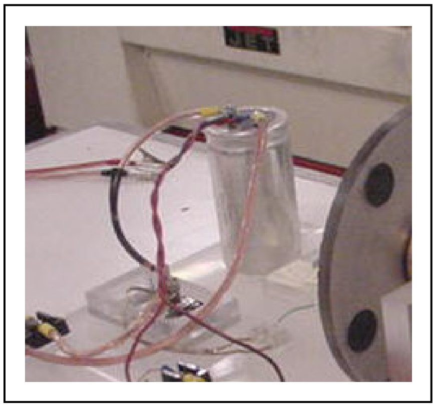
In the Bedini SG circuitry, capacitors are used to store charges coming from the coil and discharging them into the batteries. For model builders, the question is, what kind of capacitor works the best? Luckily, just about every kind of capacitor that can be considered appropriate for this application has been tried!



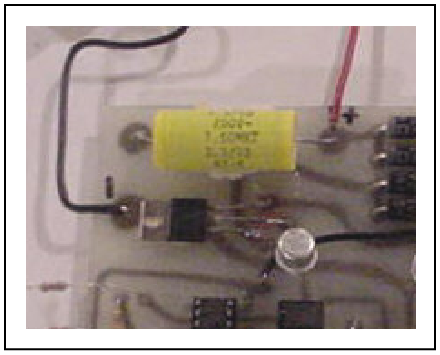
In this picture, you see three 20 volt, "1 Farad" capacitors connected in series to produce a 60 volt, 330,000uf capacitor. This capacitor set-up was charged to about 3 volts above the batteries and discharged about once a second through a rotating brush contactor.



This machine was one of the "self-runners" that John demonstrated in 2002. It ran for over 6 weeks straight, just rotating the batteries from front to back. So, very large capacitors discharging relatively high current, low voltage impulses is certainly a method that works.



In this picture, a capacitor rated at about 18,000uf @ 40 volts is tested on one of the many "test stands" built between 2002 and 2006. This particular arrangement was never tested for "self-running", but it illustrates that capacitors in this range were explored. This type of capacitor was originally designed as a power supply, filter capacitor.



And, of course, these small, yellow capacitors that are rated at 3.3uf @ 250 volts, originally used in Bedini Audio Amplifiers, have been extensively tested. The end result of years of work and hundreds of individual tests have lead to the following recommendations.

The best type of capacitor for the application of being charged by an SG oscillator and then discharged into a battery is a "Photo Flash" type of electrolytic capacitor. They are designed specifically for rapid discharge, so they produce a very low impedance "source" for the battery. They also seem to produce the "temporary electret effect" very well. These two characteristics seem to be the most important.

Here is an example of this type of capacitor, rated at 15,000uf @ 80 volts. They come in a variety of sizes and voltages, so experimenting with different scale machines is possible.

Completeness and Frequency of Discharge:

OK, we have discussed the various types of capacitors that have been used. We have discussed the methods to discharge the capacitor using mechanical contacts, transistors, MOSFETs, and SCRs. We have discussed the various ways to trigger the discharge using mechanical timing, electronic timing and even voltage sensing. Now, we are going to look at how various systems come together, what their circuit characteristics are, and how that effects the energy being transferred to the battery.

The two most important circuit characteristics are:

1. how much resistance is introduced into the circuit by the switching method
2. how precisely can the discharge be controlled by the switching method and the timing method

Let's, once again, review the methods we have discussed before with these two criteria in mind.

1) Mechanical Switching with Mechanical Timing

The mechanical contactors that John used in his experiments worked extremely well. The ones that used silver brushes and copper conducting strips in the Delrin wheels worked the best, with an effective resistance near zero. Experiments that used brass or bronze strips in the Delrin wheels did not work as well. No "self-running" systems were ever demonstrated using brass or bronze in the conducting strip. This lowering of the effectiveness of the system was due to the increased electrical resistance in the brass or bronze members.

The precise timing of the discharge was not very good with the mechanical brush. Typically, the capacitor was connected to the battery far longer than it took to fully discharge, so vital "recharge time" was lost before the next discharge. Also, if the voltage difference between the capacitor and the battery was too high, the arcing at the brush tended to degrade the front lip of the copper bar (as seen on page 33), which also lowered the over-all effectiveness of the method.

2) Transistor Switching with Electronic Timing

Of all of the switching methods discussed in this book, the NPN Bi-polar Power Transistor introduces the highest resistance into the switching circuit. The .6 volt drop across the semi-conductor junction adds a significant resistance barrier to the otherwise high frequency, low impedance connection between the capacitor and the battery. This arrangement was only used when the batteries were small, and the capacitor voltages were at least 30 or 40 volts above the battery, to minimize the percentage of loss.

In spite of the fact that electronic timing methods could be used to optimize the contact time, I never saw an SG system attain the "self-running" mode using bi-polar transistors to switch the capacitor discharge.

3) SCR Switching with Electronic or Automatic Timing

Of all of the electronic devices used to effect the discharge of the capacitor, the SCR has the lowest resistance. It introduces no voltage drop across the semi-conductor junction (0.00 volts) and when triggered, it begins conducting quickly at full power. It requires very little energy to trigger and shuts off automatically when the voltage between the capacitor and the battery equalize. In many ways, it seems like the ideal device for this application.

Remarkably, I have never seen a "self-running" system use an SCR to discharge the capacitor into the battery, although I do believe that such a system could be developed. The primary weakness of the SCR switching method is that it requires the capacitor to discharge all the way down to the battery level and remain there until the current transfer stops. Under most circumstances, it is not possible to get the SCR to re-set until this happens. For systems in the low to medium voltage range, this can really "flatten out" the benefit otherwise available from the "temporary electret effect" and its spontaneous recharging of the capacitor.

4) MOSFET Switching with Electronic or Automatic Timing

As we start to approach the understanding of the "sweet spot" for this phenomena, we see that the SCR's weakness is that it cannot be turned OFF when we want it to be. The MOSFET switch appears to be the best device because it has the lowest resistance for any device that allows us total control of the timing.

It has a .3 volt drop across its semi-conductor junction, which puts it about halfway between the SCR and the Bi-polar Transistor. However, the device can be turned ON and OFF very rapidly, if necessary. This gives us a whole new opportunity to explore, and that is, to turn the capacitor discharge off BEFORE the capacitor is completely discharged.

The MOSFET Switch gives us the ability to partially discharge the capacitor. By doing so, we can deliver a short, sharp (high voltage, high current) impulse to the battery while taking best advantage of two other benefits. These are:

1. the time interval to the next "full charge" state is shortened
2. the "temporary electret effect" is allowed to provide the largest percentage of the voltage recovery in the capacitor per cycle

This gets us directly back to Tesla's "Method of Conversion" where, with the least energy input, we can deliver the highest number of high energy impacts to the battery in the shortest amount of time.

In order for you to understand the importance of this, I quote from page 80 in the Beginner's Handbook: "The first thing you must know is that the 'state of charge' in the battery is a CHEMICAL condition, not an ENERGY condition" and "**Anything that restores this chemical condition in the battery is contributing to the charging process."**

Optimum Discharge Circuits:

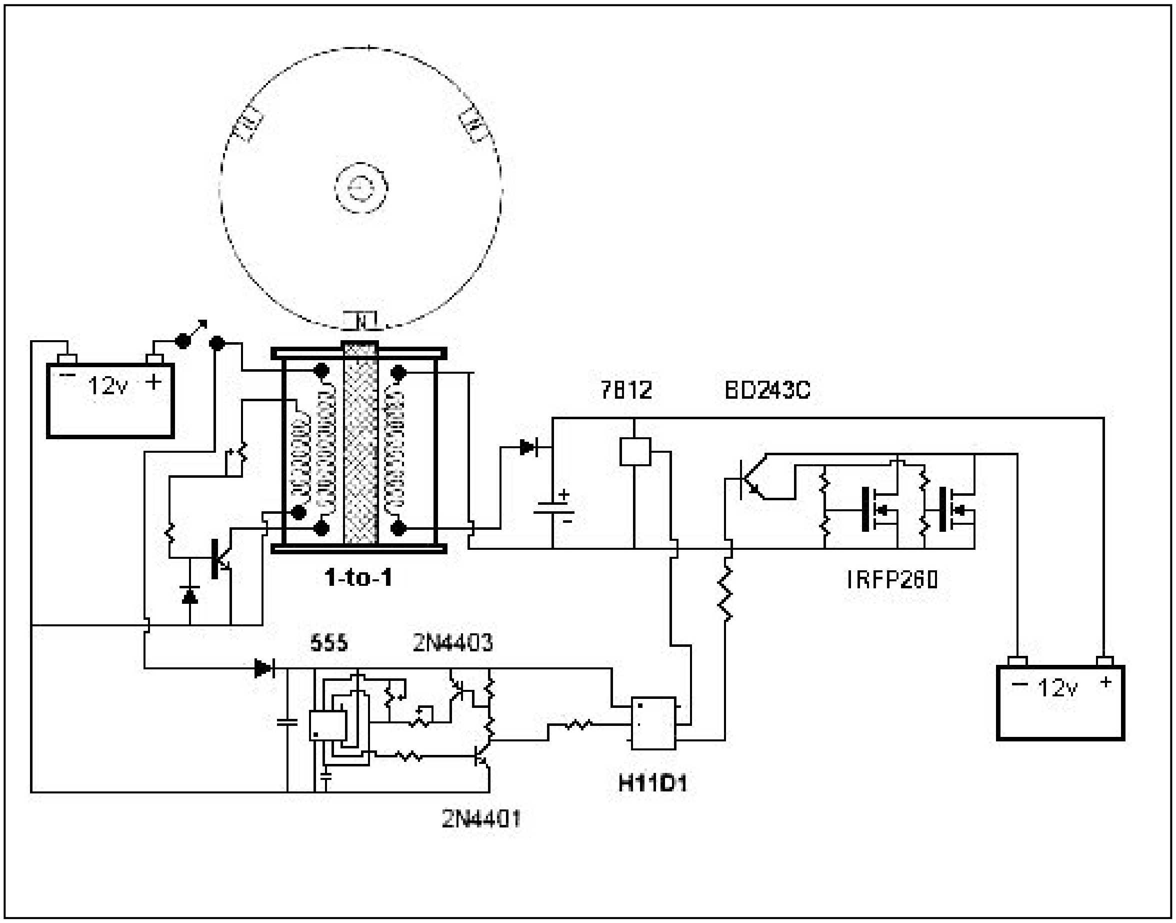
John has developed an automatic discharge circuit that optimizes the capacitor discharge and the battery charging process. It has repeatedly produced the highest COPs for any SG Energizer that I have ever heard of. That number is a COP > 1.25.

Of course, these capacitor discharge circuits are for sale, and for the time being at least, remain the proprietary property of John's company. The circuits come potted, to prevent tampering, so I can't tell you exactly how it works. What I can tell you is what you would see if you put this circuit on your SG Energizer between the output and the battery and measured everything that was happening to the capacitor.

The capacitor section of the circuit can plainly be seen to consist of 4 of the 80 volt, 15,000uf photo flash capacitors I show on page 42. This makes the value of the capacitor to be 60,000uf @80 volts. This capacitor is charged to approximately twice the battery voltage, so for a 12 volt system, the cap is charged to around 24 volts. The capacitor is discharged by an automatic circuit that senses the voltage and the discharge is interrupted when the voltage in the capacitor drops to about 5 volts above the battery.

The question is, is there a way to simulate this circuit behavior using an electronic timer? The answer is YES! All we need to do is build a 555 timer where we have independent control of the ON time and the OFF time of the timing cycle. Then, the ON time control will let us select the exact amount of time that the capacitor is discharging, and the OFF time control will let us select the exact amount of time that the capacitor is charging. As long as the system is running in a stable window, the results will be quite good!

The circuit diagram is shown on the next page. It includes two IRFP260 MOSFETs switching the negative line between the capacitor and the battery. The main discharge capacitor should be of the Photo Flash type with a value in the range of 60,000uf @ 80 volts or whatever you choose.



The NPN transistor turning the MOSFETs on is the BD243C or any suitable replacement. Since the capacitor is varying in voltage, the voltage to the control section is managed by a voltage regulator 7812 or any suitable replacement. Resistors on the MOSFET gates are 1K or suitable variant.

On the timer side, the main timer chip is any version of the 555 timer, such as the TS555CN or equivalent. The diode on the positive rail feeding the timer can be a 1N914 or a 1N4148. The small capacitor just before the 555 can be 100uf @ 25 volts electrolytic. The timing cap between pin 2 and ground is about .80uf @ 25 volts. Both potentiometers are 1 megohm. The resistor between pin 3 and the base of the 2N4401 can be anything between 2k and 10k. The two resistors between the positive rail and the collector of the 2N4401 are 2K and 1K with the 1K resistor connected to the collector. The resistor feeding into the H11D1 is 330 ohm. The resistor feeding to the base of the BD243C is 2K or suitable variant.

This circuit will allow you to completely control the charge and discharge timing of the capacitor. The 1 megohm pot coming off of the collector of the 2N4403 controls the "on time" of the timer and the "discharge time" of the capacitor. The other 1 megohm pot controls the "off time" of the timer and the "charge time" of the capacitor. Increasing the resistance of the pots increases the time duration for these functions. You can also add a 1K resistor in series with each of these 1Meg Pots so the value of the resistance cannot drop to zero.

So, you can manually set the discharge time to a very short interval that only partially discharges the capacitor, and likewise set the charge time so the capacitor charges to whatever voltage you want.

By watching the voltage of the capacitor on an oscilloscope, you can easily see what the potentiometers do and set them according to your own needs.

Variations on this circuit include using more than two IRFP260 devices to discharge larger capacitors. Don't forget to put them on a heat sink! There are also other 555 circuits that can provide the same control features for the process. Use this one if you like, or any other one you prefer.

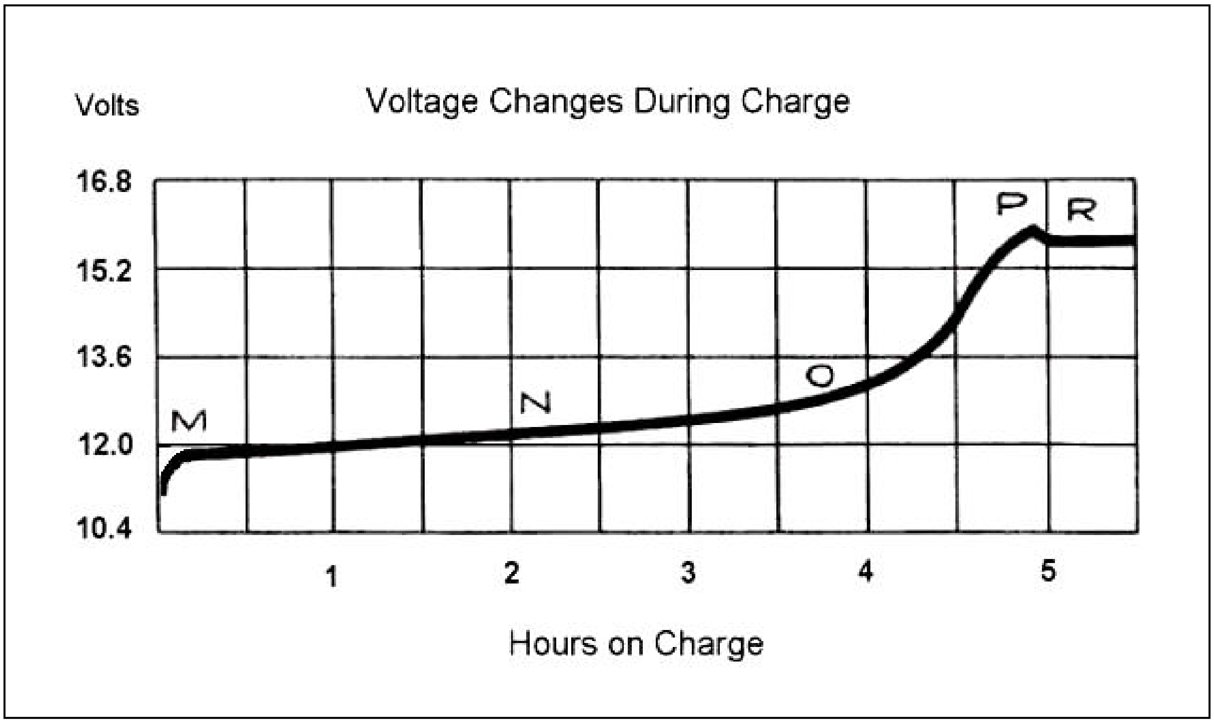
Chapter Six

Battery Charging Benefits

There are three separate and distinct benefits to charging batteries this way over standard charging methods. The first benefit is caused by Tesla's "Method of Conversion", which gives us a "power gain" in the system, and allows us to apply electricity to the battery in high density impulses.

The second benefit is caused by the "temporary electret effect" in the capacitors, which gives us a true "energy gain" due to the voltage recovery in the capacitor produced by the unmeterable electrostatic component of the inductive discharges from the coil.

The third benefit relates to the "charge finishing time" and has never been discussed in the public forms. In some ways, this is the biggest gain of all.



Here is the illustration from page 78 in the Beginner's Handbook. It shows the voltage profile of a battery as it charges and what happens at the end of the charge as the chemistry "finishes." To review this process briefly, the voltage rises slowly from point M to point O, then rises more quickly from point O to point P. Point P represents the point at which there are no more sulfate ions in the plates and the voltage has risen to its highest value. Any further applications of electricity to the battery beyond this point can only produce electrolysis, since the chemical charging process is "finished."

This is all interesting and theoretical, but what does it look like in real life? To find out, John and I started graphing charge cycles on a computer in 2004, during the development of the first Golf Cart battery charger produced by Energenx, Inc.

In order to appreciate what you are about to see, you need a little bit of background. The charger under development was being modified every couple of weeks. In this phase, the general type of changes being made were increases in the power level. To produce significant data in the charge graphs, a standardized discharge protocol was instituted.

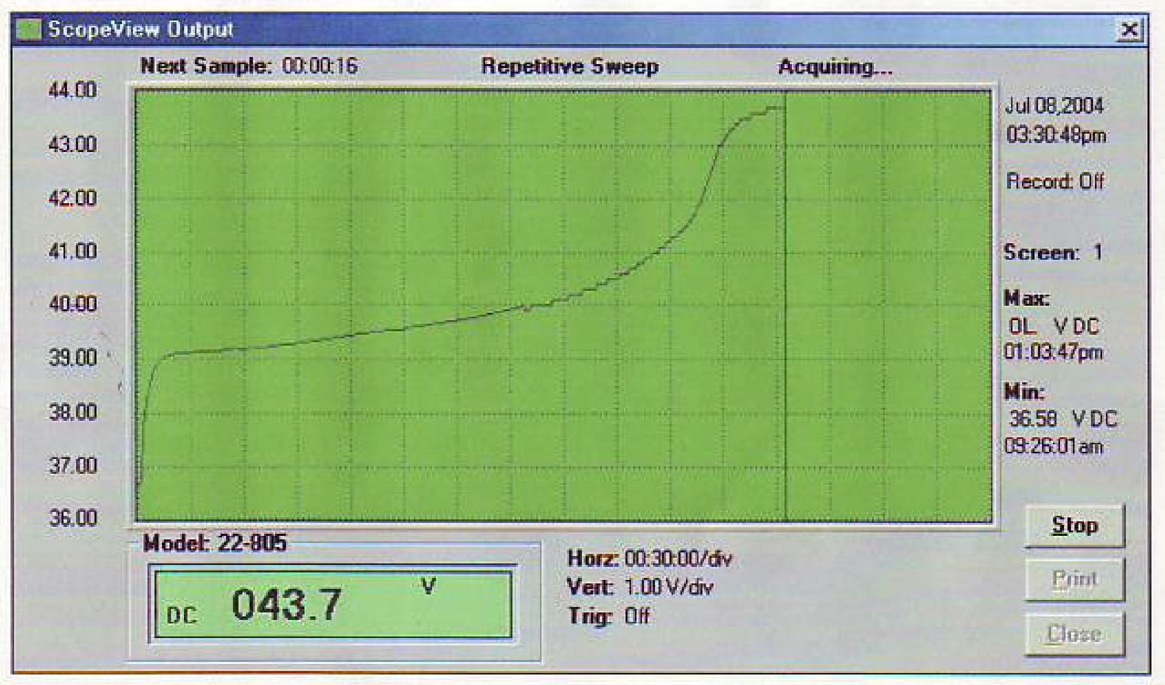
During this period, the Golf Cart was driven 6 miles each day, first thing in the morning, and then put on the charger to charge all day, so we could observe the process. The batteries would sit over night, fully charged, and the golf cart was taken out again the next morning. This rest period was typically 16 hours between the end of the charge cycle in the afternoon and the beginning of the next discharge cycle early the next morning. Over the weekends, the batteries would rest about 64 hours before the next discharge. Three day weekends provided an 88 hour rest for the batteries, but they were always left fully charged.

John has always told people if they wanted to see the system work at its best, they need to "condition the batteries" and just let the system run. Before the data collected from the Golf Cart test runs, we knew this was necessary, but we didn't know exactly why it worked. After these tests, we knew we had found the reason.

The charging chart on page 49 suggests that about 2/3rds of the charge time is spent on the "charge plateau" (between points M and O) and about the last 1/3rd of the charge time is spent in the "finishing phase" (between points O and P). What we found is that this is not always true.

The following four images illustrate what we discovered. These graphs have never been shown to the public before, and remain the copy righted, proprietary property of Energenx, Inc. In each case, the power level of the charger was the same, and the discharge before the charge that is graphed is also the same, representing driving the Golf Cart for 6 miles.

So, here is the first image, taken of the finished charging graph on Thursday, July 8, 2004. The major horizontal grid (left to right) shows time elapsed in 30 minutes per division. The major vertical grid (down to up) shows battery voltage as 1 volt per division, indicated on the left column.



Next Sample: 00:00:16
Repetitive Sweep
Acquiring...

Jul 08,2004
03:30:48pm
Record: Off
Screen: 1
Max:
OL V DC
01:03:47pm
Min:
36.58 V DC
09:26:01am

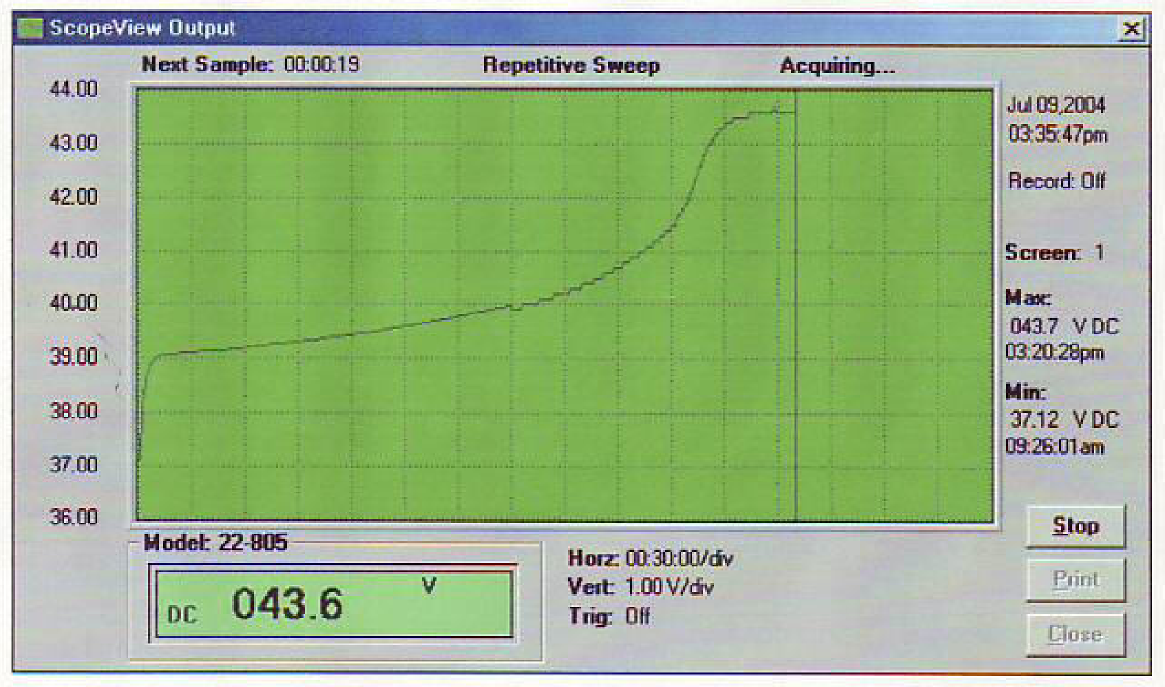
Model: 22-805
DC 043.7 V

Horz: 00:30:00/div
Vert: 1.00 V/div
Trig: Off

Golf Cart Driven 6 miles and put on Charger.
Charge Profile on Thursday, July 8, 2004. Voltage Tops in just about 6 hours.

Point M is established in about 10 minutes. Point O occurs at about 4 hours. Point P happens at about 6 hours. So this graph generally follows the rule.

The next example is the graph produced from the test run on Friday, July 9, 2004. Again, point M is established in about 10 minutes. Point O occurs at about 4 hours, and point P happens at 5 hours and 45 minutes.



Next Sample: 00:00:19

Repetitive Sweep

Acquiring...

Jul 09,2004
03:35:47pm

Record: Off

Screen: 1

Max:
043.7 V DC
03:20:28pm

Min:
37.12 V DC
09:26:01am

Model: 22-805

DC 043.6 V

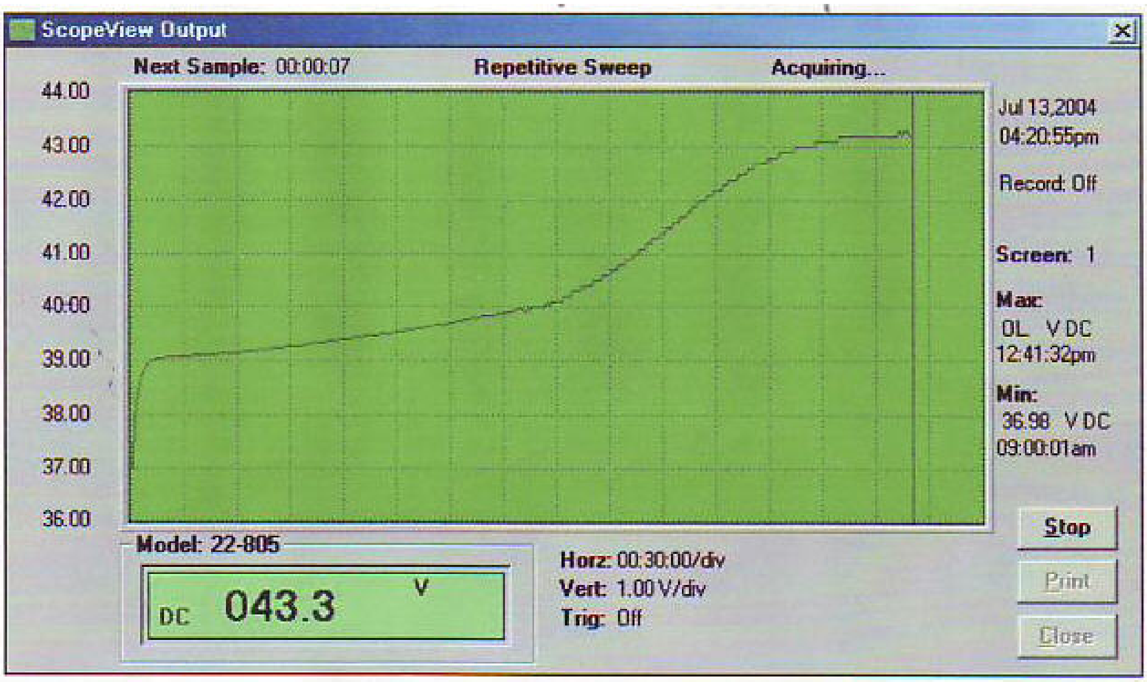
Horz: 00:30:00/div
Vert: 1.00 V/div
Trig: Off

Golf Cart Driven 6 miles and put on Charger.
Charge Profile on Friday, July 9, 2004. Voltage Tops in a little under 6 hours.

These two graphs look very similar, and are, in fact, showing a slight increase in the efficiency of the battery. Mind you, the batteries in this Golf Cart were 13 years old, having been purchased in 1991. They had been considered "dead" twice before these tests, but were obviously responding quite well to these experiments.

You may also have noticed that the vertical rise of the voltage near the end of the charge is much steeper than the graph on page 49 indicates. Up to this time, we had noticed some variation in the "finishing time" of the charge, but since we were also changing the power level of the charger under development, we had not yet considered these different charge characteristics significant. Right at this time, we were presented with a 3 day weekend. So, on Tuesday, July 13, 2004, we drove the Golf Cart 6 miles in the morning and put it on the charger for the rest of the day.

Here is the graph that was generated that day.



ScopeView Output

Next Sample: 00:00:07

Repetitive Sweep

Acquiring...

Jul 13,2004
04:20:55pm

Record: Off

Screen: 1

Max:
OL V DC
12:41:32pm

Min:
36.98 V DC
09:00:01am

Model: 22-805

DC 043.3 V

Horz: 00:30:00/div
Vert: 1.00 V/div
Trig: Off

Golf Cart Driven 6 miles and put on Charger. Charge Profile on Tuesday, July 13, 2004, after a three day weekend. Voltage takes 7 hours and 15 minutes to Top.

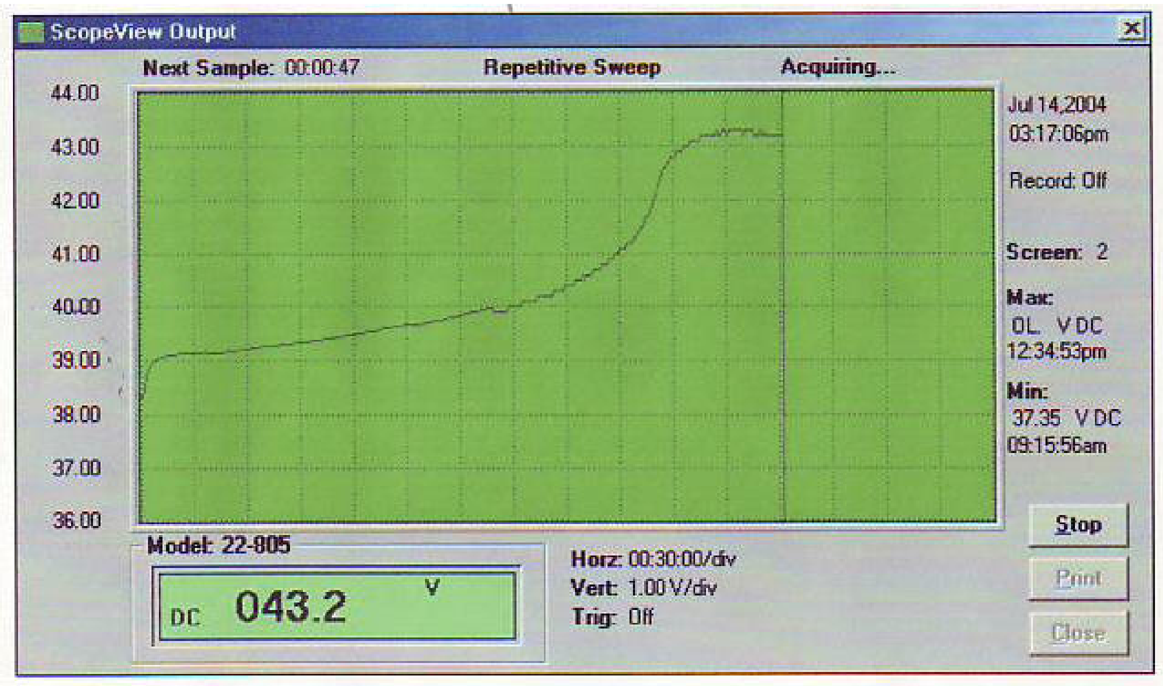
Point M is established in about 10 minutes. Point O occurs at about 4 hours. But now the "finishing phase" of the charge has changed! Point P does not happen until about 7 hours and 15 minutes into the charge cycle.

Neither the discharge amount nor the charge rate of the charger have changed from the two previous cycles. But clearly, something has changed in the battery requiring it to take another hour and 15 minutes to finish charging. The question is....WHAT has changed?

In the two previous cycles, it looked like the battery was recovering, and actually charging in less time, so this graph looked like something "bad" had happened. On Tuesday evening, we were confused, not really knowing what we were looking at.

So, on Wednesday, July 14, 2004, we repeated the experiment again. We drove the Golf Cart for 6 miles and put it on the charger all day.

Here is the graph that was generated that day.



Next Sample: 00:00:47

Repetitive Sweep

Acquiring...

Jul 14,2004
03:17:06pm

Record: Off

Screen: 2

Max:
OL VDC
12:34:53pm

Min:
37.35 VDC
09:15:56am

Model: 22-805

DC 043.2 V

Horz: 00:30:00/div
Vert: 1.00 V/div
Trig: Off

Golf Cart Driven 6 miles and put on Charger.
Charge Profile on Wednesday, July 14, 2004. Voltage Tops in about 5½ hours.

Point M is established in about 10 minutes. Point O occurs at about 3 hours and 45 minutes. Point P happens at 5 hours and 30 minutes. So, the long "finishing phase" has disappeared again, and it is back to looking like the battery continues to recover and is charging in less time. The battery is also topping at a lower voltage, suggesting a drop in impedance (a good thing).

Over the course of the summer, this pattern repeated itself consistently. When the battery was charged and used the next day (about 16 hours rest) the finishing phase was shortest. When there was one day off in-between the charge and the next discharge (40 hours), the finishing phase started becoming longer. With two days off (64 hours) the finishing phase grew longer still. With 3 days off (88 hours) the finishing phase was like the graph on page 53. With 4 days off (over 100 hours) the time it took to finish a charge cycle maxed out. Any further delays in using the battery did NOT increase the charge time required to finish the charge. Whatever allowed the battery to finish its charge early seemed to dissipate in about 100 hours.

The questions remained. What were we looking at? What caused the finishing time to vary? Up to this time, I had been a vocal proponent for the "chemical explanation" of what was going on in the battery. But this phenomena seemed to defy logic. There seemed to be no reasonable chemical explanation that made any sense.

First of all, this finishing time variation did not occur when the battery was charged using conventional methods. At least, we had never seen it. We had also never seen it reported in the literature. We had to ask ourselves whether we were looking at a new battery behavior elicited by the charging method we were experimenting with? At that point, we didn't know.

Here is what we do know now:

1. This phenomena shows up when batteries are charged with either capacitive or inductive discharges.
2. This phenomena does not show up when batteries are charged by rectified transformer outputs or by DC power supplies.
3. This is the nature of the "conditioning" that is required to maximize the over-all efficiency of an SG Energizer.
4. This "conditioning" is temporary, as it dissipates within 100 hours.
5. It demonstrates why the machines that are cycled continuously outperform the ones that are tested or worked on "once in a while".

The bottom line is this. If you take the total time the battery took to reach its "topping voltage" in the last two graphs (pages 53 and 54) the battery took 24.2% less time to charge on July 14th than it did on July 13th. This is a huge difference in the amount of electrical energy applied to the battery, especially considering that the end result of the chemical state of charge is identical in both cases.

In chapters two and three of this book, I have discussed the idea that electricity can exhibit "inertial properties" under certain circumstances. John and I were confronted with the possibility that this was another "unmeterable" presentation of these effects. We didn't know, but there was one more phenomena that routinely showed up that helped shed some light on this.

Before we learned about how the charge in a battery "finished" and topped out at a maximum voltage, John had seen another phenomena. It first showed up in his experiments with the "G-field generator" developed by Raymond Kromrey. Later, the same phenomena was strongly apparent from the SG Energizers.

During the last phase of charging, after the voltage had risen to 13.5 and above, a strange thing happened. If the battery was disconnected from the charger, the voltage did NOT drop very quickly. I have personally seen batteries take over 90 minutes to drop from 14 volts down to the normal resting voltage of 12.6. When charged by a conventional charger, the excess voltage of the battery will drop down to 12.6 volts in a few minutes.

This tendency for the voltage of the battery to sustain itself, well above the normal resting voltage, lead us to believe that the battery continued to charge ITSELF even after it was disconnected from the charger. This idea was also supported by the fact that the cells continued to "off-gas" (produce hydrogen) during this period! John coined the term "over-potentializing the electrolyte" in an attempt to explain this process.

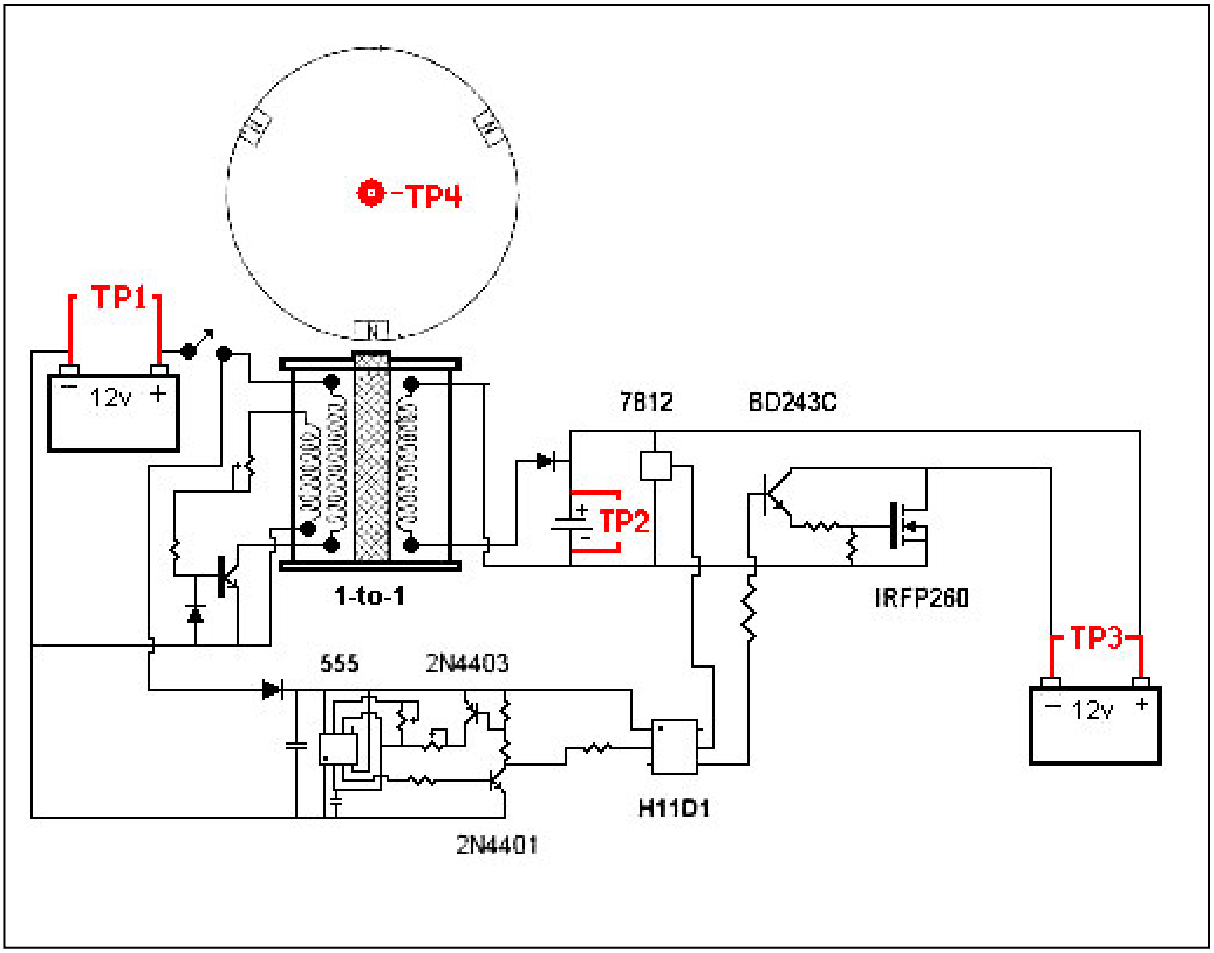
There was no "chemical" explanation for any of this! We were seeing significant, unmeterable benefits in the battery charging process that no standard chemical or electrical theory could explain. Currently, we believe that this "self-charging" process is the pre-cursor to the shorter "finishing phase" of the charge illustrated on pages 51, 52, and 54.

This only shows up when the batteries are charged in ways that release the inertial properties of electricity. This can be called "Radiant Energy", Phi-Dot current, electrostatic potential, longitudinal waves, or a host of other names. What it is called is not important. What is important is that this phenomena is REAL, and that it provides a number of battery charging benefits that cannot be quantified by standard methods or meters.

Chapter Seven

Measuring Input vs Output

Now that you are able to minimize the energy going into your Bedini SG Energizer and maximize the energy coming out of it, the time has come to seriously look at ***MEASURING*** these values. The various places in the circuit where power gains and energy gains show up have already been explained to you. So this is how John measures the energy functions of the machine to arrive at a reasonable COP rating.



The image above shows four "test points", labeled 1, 2, 3, and 4.

These are the locations where meaningful data can be gathered in your attempt to understand the **REAL** energy economy of your Bedini SG Energizer. These locations are:

1. The Input Battery
2. The Output Capacitor
3. The Output Battery
4. The Output Shaft of the Wheel

Measuring Inputs:

The energy Input to the machine is the easiest to measure and understand. Test Point #1 represents the idea of measuring all electricity that leaves the "run battery" during operation of the SG Energizer. It can be as simple as an:

1. Analog Volt Meter across the battery terminals, and an
2. Analog Amp Meter located where the "ON/OFF switch is shown

For basic measurements, these devices work quite well and are usually about 98% accurate. Even though the Amp Meter is measuring intermittent current in pulses, analog meters do a respectable job of "averaging" these values and giving a continuous reading of that average.

For more accurate readings, a dual trace oscilloscope can be used with one channel monitoring the voltage across the battery and the second channel monitoring the voltage drop across a calibrated resistor, placed where the ON/OFF switch is. A second option for current measurement is to use a calibrated "current probe" plugged into channel two of the scope.

Which ever method you use, it will measure "all electrical inputs" including all of the electricity used by the SG oscillator as well as all of the electricity used by the 555 timer circuit. This represents 100% of the energy you are required to put into the machine in order for it to operate. Nothing else is required EXCEPT the small amount of mechanical energy needed to start the wheel spinning. This small mechanical input is usually disregarded in the over-all calculations, but is mentioned here, to be accurate.

Measuring Outputs:

There are two basic outputs from operating the SG oscillator. Both are consequences of the current moving in the Main Coil. The first output is produced when the magnetic field is present, and that is the mechanical energy that turns the Wheel. The second output is produced when that magnetic field collapses and is the high voltage spike that charges the capacitor. So, let's look at the electrical output first. We'll get back to the mechanical energy a little later.

The nature of the inductive collapse is quite controversial and measuring its precise energy quantity is difficult, even with extremely high speed oscilloscopes. So, the first place in the circuit where the energy quantity can be seen and measured is at Test Point #2, which is at the capacitor.

Test Point #2:

The energy in a capacitor can be measured in Joules and is equal to one half of the capacitance, rated in Farads, times the voltage squared. The formula looks like this:

$$E = \frac{1}{2} C V^2$$

If you place an oscilloscope across the capacitor, you can watch the voltage rising and dropping as it charges and discharges. Two calculations can be made for the energy stored in the capacitor. One for how much energy is in the capacitor when its voltage is lowest, and one for when its voltage is highest. The difference is how much energy it is delivering to the battery during each discharge. The last piece of significant information is: how many times is the capacitor discharging into the battery per second?

So, one Joule is equal to one Watt-second. The first calculation will tell you how many Joules are delivered to the battery in one capacitor discharge, and the second calculation will tell you how many discharges per second. When these are multiplied together, you get how many Joules per second the system is delivering to the battery.

So, this first Output measurement is measured in Joules per second, or Watt-seconds per second. The seconds cancel out, and so the numerical value of the calculation is in the units of Watts.

The Input was measured in volts times amps equals watts, and now our first Output measurement is also measured in watt-seconds per second equals watts. So this gives us our first, reasonable comparison point.

Efficiency is usually defined as the ratio of the Output divided by the Input producing a decimal fraction. When this decimal is multiplied by 100, the efficiency can be presented in its usual percentage form.

$$\frac{\textbf{OUTPUT in Watts}}{\textbf{INPUT in Watts}} \ \mathbf{X \ 100 = 50\%} \text{ (or whatever)}$$

When the SG Energizer is operated in the Attraction Mode and the capacitor has low leakage, a 50% measurement here is quite good. When the SG Energizer is operated in the Repulsion Mode and the capacitor has low leakage, a 35% measurement is more typical.

There is one point here that should not be forgotten. Any voltage reading taken at the capacitor can NOT determine how much of that voltage charge is coming from the coil and how much is coming from the "temporary electret effect" in the capacitor. So, in spite of our attempts to quantify the electrical energy being recovered directly from the magnetic field collapse, we still don't know, exactly. No matter how carefully we measure these voltages and calculate these energy movements, there is a factor here that we cannot quantify without a much more complicated procedure.

Test Point #3:

The end of the circuit is the Output Battery. This is the battery being charged by the circuit, and its "state of charge" is the last and most important indicator of the "efficiency" of the machine. From the last step, we have a fairly "accurate" measurement of how much electrical energy we are delivering to the Output Battery. The voltage reading on the Output Battery is Test Point #3. However, during the charging process, the moment to moment voltage reading is not enough information to determine the instantaneous "state of charge" of the battery. There is actually only ONE PLACE where we really know the "state of charge" of the battery, and that is at the END of the charge, when the voltage tops out indicating that the chemistry is "finished".

All other measurement points on the battery are relative. That includes:

1. the resting voltage
2. the specific gravity of the electrolyte
3. the temperature, and
4. the internal impedance

Only when the voltage tops out does the battery "tell us" that there is nothing else we can do to increase its charge. This is the only reliable and absolute indicator of the "state of charge" of the battery.

And again….(harp, harp)….. the fully charged state in the battery is a CHEMICAL STATE where the negative plate is composed entirely of sponge lead, the positive plate is composed entirely of lead-peroxide, and the electrolyte is composed entirely of water and sulfuric acid (H_2SO_4).

The ***IDEA*** that it takes a specific quantity of electricity to create this chemical state in the battery goes back to the published work of Michael Faraday in 1840. While this published work was monumental in its day, the ordinary behavior of your Bedini SG Energizer clearly demonstrates that Faraday's methods and conclusions **did not define all there is to know about this phenomena**. Chapter Six of this book shows some of the strongest evidence ever published that there are here-to-fore unreported qualities in electricity that can greatly modify Faraday's results.

From an electrical point of view, there is nothing you can do to estimate "how well" the battery is charging during the process. All you can do, is determine exactly when the charge process is finished!

Test Point #4:

The only other Output from the machine is the mechanical energy that turns the wheel. This mechanical energy must be measured mechanically using a dynamometer. Complete directions on how to build a small, fractional horse-power dynamometer are given on this educational film:

http://www.youtube.com/watch?v=Zox7EnafQmE

For Bedini SG Energizers running on the Repulsion Mode, mechanical energy production is about 28% of electrical input. For models running on the Attraction Mode, mechanical energy production can be closer to 35%. This is at least true for the models with the bicycle wheel, ceramic #8 magnets and a multi-winding coil, like the design specified in the Beginner's Handbook.

In the next part of this series, **Bedini SG, The Complete Advanced Handbook**, we will explore the methods to convert this mechanical energy back into more electricity, to charge the back battery even more. But for this stage of the work, quantifying the energy on the wheel with a dynamometer is as far as we go.

Other Factors:

OK, we have discussed the most logical Test Points on the machine. One other set of conditions that are easy to identify are the places in the circuit where there are obvious losses of energy back to the environment. Technically, these are all Outputs that can be measured and added to the final efficiency calculations. They include:

1. heat at the main switching transistors
2. heat at the capacitor discharge MOSFETS
3. heat generated anywhere else in any other circuit components
4. I^2R losses, hysteresis in the coil core material, noise
5. air moved by the fan and the wheel spokes

Each of these represent energy produced by the system that cannot be recycled and reused. So, any gain seen in the operation of the Energizer is more than making up for these outputs (losses), as well.

Measurement Realities:

As you can see, it is possible to measure a number of energy movements through the machine. Remarkably, none of the Output measurements give any real clue about how quickly the second battery is charging. Most "self-respecting scientists" taking measurements on your Bedini SG Energizer at the Input (Test Point #1) and at the Output (Test Point #3) would easily determine the efficiency at 50% or less, and quickly dismiss any rumors of COP>1 operation as existing somewhere in the realm between "mistaken" and "delusional."

The bottom line is this. None of us who have been involved with John's invention for a long time know how to measure the efficiency of the complete system when the measurements are taken on the machine. All the simple measurements of the Input and Output, that we know how to take and calculate correctly, lead to erroneous conclusions about the real energy economy of the system.

John has always said that it is the machine's effect on the Battery that leads to the understanding of the energy gain in the system. The only thing we know for sure is how to cycle the batteries and recognize when the battery being charged is finished. All other anomalies lead to the recognition that we still do not know "what electricity is" and therefore do not presume to understand all of its behaviors.

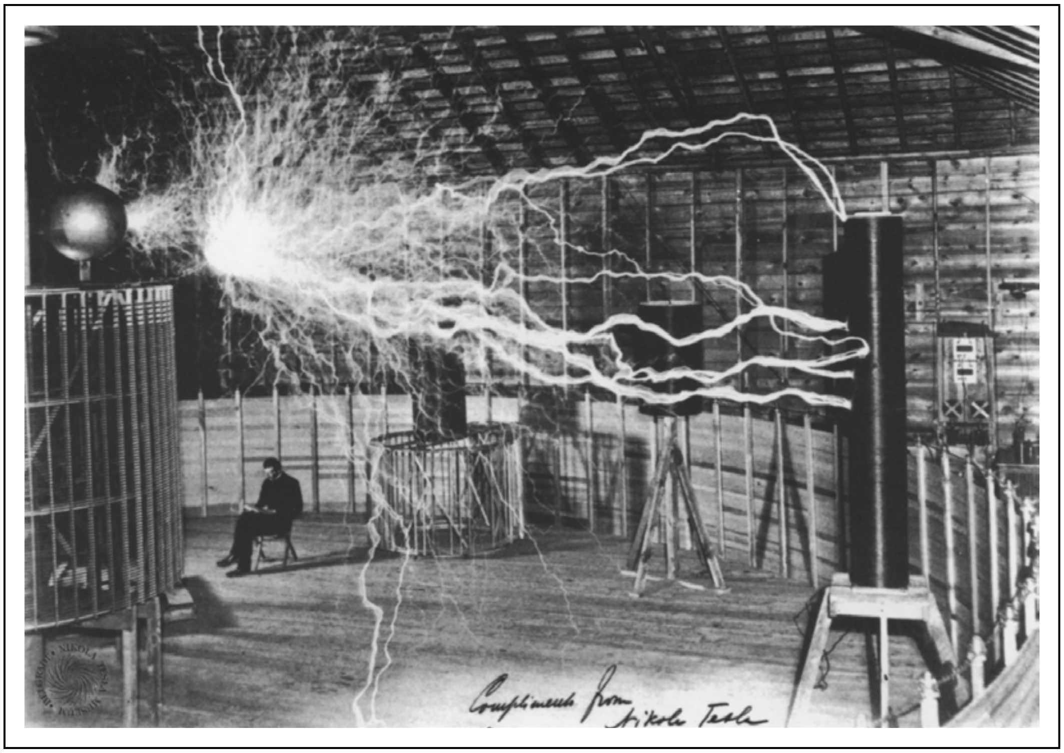
It is still a good exercise to do learn how to do all of these measurements, so when the next "expert" shows up and tells you you're crazy, you can show him he's right!

Chapter Eight

Summary and Conclusions

> "The day when we shall know exactly what 'electricity' is, will chronicle an event probably greater, more important than any other recorded in the history of the human race."

Nikola Tesla wrote those words in 1893 and spent the better part of his life exploring the nature of electrical phenomena. During this period of discovery, he found a way to transform a relatively low voltage, low current, high impedance supply of electricity into a relatively high voltage, high current, low impedance source of rapidly repeating impulses. With this new "Method of Conversion" Tesla could expend modest amounts of electrical energy to produce some of the most colossal displays of electrical phenomena ever achieved.



Using only coils, capacitors, spark disrupters and high speed rotating contactors, Tesla was able to demonstrate behaviors in electricity that very few people know anything about today. And because he was limited to these relatively primitive circuit control mechanisms, he was also limited to demonstrating these effects at relatively high voltage.

Even so, he did identify a number of significant combinations of components that produce their "magic" at almost any voltage levels, high or low. This simple combination of electrical components includes a coil of wire that is operated on an intermittent supply of direct current (DC) so that the coil is magnetized and de-magnetized in a rapid sequence. The electrical energy returning to the circuit from the de-magnetization of the coil is then directed to charge a capacitor.

This capacitor is built in such a way as to be susceptible to the particular qualities inherent in the energy coming from the coil. In particular, I refer to his use of Bees Wax in the dielectric of the capacitor, which tends to be able to store electrostatic stress and partially recharge itself after discharge.

Once charged, the capacitor is then discharged into a circuit of low impedance, so that its entire charge may be expended in an extremely short period of time. As this process is repeated with only short intervals in-between, it produces a longitudinal wave-front of electric energy that can propagate down a single wire with no return, like sound waves traveling through the air from their source to the next listener. By 1899, he had proved that he could use the earth itself as that "single wire" and propagate electricity to any location he wanted to by a method he called "wireless."

By 1900, he still didn't possess a complete understanding of electricity, but he did feel confident to say this in a published article:

> "Whatever electricity may be, it is a fact that it behaves like an incompressible fluid and the earth may be looked upon as an immense reservoir of electricity."

By the time he proved that high levels of electrical energy could be distributed to any location on the earth, with no means of ever being metered, he was black listed by the industrial bankers and his work was never financed again. We will never know what else this great genius could have accomplished if his work had been allowed to continue.

Summary:

In the last 35 years, through a process of exhaustive experimental research, John Bedini rediscovered most of Tesla's anomalous findings about the true nature of electricity. But this time, these electrical properties were being demonstrated at very low voltages and with table top devices.

John also made two significant additional discoveries to Tesla's primary methodology. John found that when the coil was being magnetized, it could also attract a magnet, producing mechanical energy. He also discovered that if the low impedance load the capacitor was discharged into was a battery, that a whole new set of electrical behaviors appeared.

The Bedini SG Energizer is a miniature model of Tesla's Method of Conversion with an added mechanical output and enhanced battery charging capabilities. Tesla was interested in industrial scale effects, so he never tried to use his methods for these applications. This is why John was granted a patent on the Mono-pole Motor, because no one had ever done it before!

In the guise of a simple toy, the Bedini SG Energizer boldly demonstrates that electricity has properties that are generally unrecognized by today's scientific community. By running thousands of experiments over decades of time, by keeping impeccable lab notes in bound volumes, by building one anomalous effect after another, John has given us the fruit of his labors.

The Bedini SG Energizer accomplishes the following. It takes a small amount of electricity from the first battery and uses it to magnetize a coil of wire. As the coil magnetizes, it attracts a magnet on a wheel, and produces a manifestation of mechanical energy. Then, the electricity coming from the battery is interrupted. This event ends the energy input to the machine.

The magnetic field in the coil then collapses and discharges a form of electricity into the capacitor that has a number of different ***qualities*** than the form of electricity that came from the battery. This form of electricity has a very high value of "voltage potential" and is sometimes referred to here as having a component of "static electricity". This is the so-called "mass free" charge, radiant energy, Phi-Dot current, or whatever else you want to call it. It is a product of the unrestricted magnetic field collapse.

When THIS type of electricity is used to charge a capacitor, it has the added ability to build up a temporary stress in the dielectric material that has a certain time-constant. We have referred to this as the "temporary electret effect." This ***quality*** in the electricity is not recognized by today's scientific standards and therefore passes to the capacitor unseen, unmeasured, and unacknowledged. Properly configured capacitors can store this quality in the electricity to partially re-establish their own voltage charge after discharge, but also pass this quality along with the rest of the electricity to the load operating on the discharges.

When this quality in the electricity is transferred to the battery, it also helps the battery raise its own potential. This is seen as the battery continuing to charge after the system is disconnected, as well as the battery moving through its "finishing phase" of the charge in much less time than normal.

So, as John would say: "That's the trick!" What really makes the system work with a COP>1 is not measurable, which is exactly what John has said all along. There has never been any attempt to mislead you or to hide the process. Gathering the evidence and developing the language to convey these ideas has, in some ways, been more difficult than developing the technology itself.

John, Aaron and Peter really hope you can appreciate this.

Conclusion:

When you have applied all of this information to your Bedini SG Energizer model, you will have a machine whose performance will rival any model that John has built for himself. You will also understand the technology at a level that far exceeds what you could have learned by studying the information on the Internet discussion forums or from any other website.

If you actually build the machine, run it and test it, and learn what it is teaching you, you will rapidly be approaching the "inner circle" of those "in the know" concerning this astonishing technology.

Thank you for wanting to learn this material. By doing so, you are helping to build a better future.

Part 3 of this series, **Bedini SG, The Complete Advanced Handbook**, will finish the project of documenting this technology. It will cover the methods of converting the mechanical energy of the wheel into more electricity to maximize the electric energy gain of the system.

Projected publishing date is late 2013.

Chapter Nine

Modifications Checklist

Here is a quick list of the modifications to your Bedini SG Energizer suggested in this book.

Minimizing Energy Input:

Basic Tuning:

- Replace 470 ohm base resistors with 100 ohm base resistors
- Add 1K, 1 watt potentiometer
- Tune operation for lowest current draw for highest wheel speed

Fine Tuning:

- Build Transistor Testing Circuit
- Test Transistors
- Find Matching Set of 7 Transistors
- Test 100 ohm Resistors
- Find Matching Set of 7 100 ohm Resistors
- Make sure that all wires in the coil have the identical length
- Install new Transistors and Base Resistors in your SG circuit
- Install 1K, 1 watt potentiometer in the Trigger loop
- Tune operation for lowest current draw for highest wheel speed

Reducing Mechanical Losses

- Re-align and re-balance wheel, if necessary
- Clean bearings and re-lubricate with light oil
- Re-adjust distance between magnets and top of coil, if needed

Build and Install Capacitor Discharge Circuit

- Make complete list of parts needed (with extras of major parts)
- Purchase all parts needed
- Assemble Timer Section
- Test Timer Section for Proper Function
- Assemble Capacitor Section
- Test MOSFETs with Transistor Tester
- Find as many Matching MOSFETs as your Circuit Needs
- Assemble Capacitor Discharge Section of Circuit
- Don't forget Heat Sinks on the MOSFETs
- Install Capacitor Discharge Circuit between SG output and battery
- Test Completed Capacitor Discharge Circuit

Other Issues

- Measure all Inputs and Outputs (for your own edification)
- Keep Good Notes on both Energizer and Battery performance
- Always Use Good Batteries and Run Continuously for Best Results

Study Tesla's Method of Conversion

- On Light and other High Frequency Phenomena
- US Patent #462,418 (included in the Appendices)
- US Patent #568,178 (included in the Appendices)
- Dr. Lindemann's Lecture "Tesla's Radiant Energy" now available at: http://teslasradiantenergy.com (Highly recommended)

Appendices

United States Patents issued to Nikola Tesla:

USP #462,418	(Means of and Apparatus for Electrical Conversion and Distribution)	Page 72
USP #568,178	(Method of Regulating Apparatus for Producing Currents of High Frequency)	Page 76

United States Patent issued to Raymond Kromrey:

USP #3,374,376	(Electric Generator)	Page 81

Article:

On Light and Other High Frequency Phenomena
Link: Tesla's Article

Other Resources:

Electronic Parts

Mouser Electronics	http://www.mouser.com
Radio Shack	http://www.radioshack.com

A&P Electronic Media

Home of the Best Collection of Information Products on the Planet! http://www.emediapress.com

Tesla Chargers

Home of "ready to use" battery chargers designed by John Bedini http://teslachargers.com

(No Model.)

N. TESLA.

METHOD OF AND APPARATUS FOR ELECTRICAL CONVERSION AND DISTRIBUTION.

No. 462,418. Patented Nov. 3, 1891.

Fig. 1

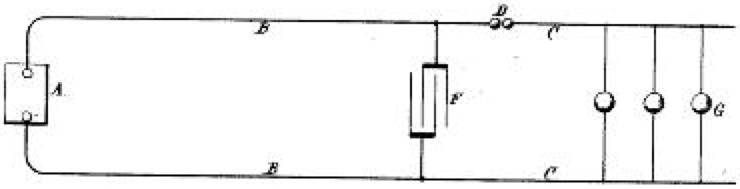
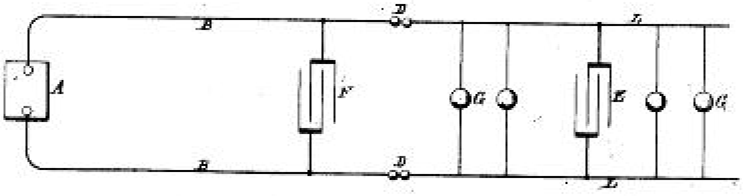


Fig. 2



Witnesses:
Raphael Netter
Frank B. Murphy

Inventor
Nikola Tesla
by Duncan & Page
Attorneys.

UNITED STATES PATENT OFFICE.

NIKOLA TESLA, OF NEW YORK, N. Y.

METHOD OF AND APPARATUS FOR ELECTRICAL CONVERSION AND DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 462,418, dated November 3, 1891.

Application filed February 4, 1891. Serial No. 380,182. (No model.)

To all whom it may concern:

Be it known that I, NIKOLA TESLA, a subject of the Emperor of Austria, from Smiljan, Lika, border country of Austria-Hungary, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Methods of and Apparatus for Electrical Conversion and Distribution, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

This invention is an improvement in methods of and apparatus for electrical conversion, designed for the better and more economical distribution and application of electrical energy for general useful purposes.

My invention is based on certain electrical phenomena which have been observed by eminent scientists and recognized as due to laws which have been in a measure demonstrated, but which, so far as I am aware, have not hitherto been utilized or applied with any practically useful results. Stated briefly, these phenomena are as follows: First, if a condenser or conductor possessing capacity be charged from a suitable generator and discharged through a circuit, the discharge under certain conditions will be of an intermittent or oscillatory character; second, if two points in an electric circuit through which a current rapidly rising and falling in strength is made to flow be connected with the plates or armatures of a condenser, a variation in the current's strength in the entire circuit or in a portion of the same only may be produced; third, the amount or character of such variation in the current's strength is dependent upon the condenser capacity, the self-induction and resistance of the circuit or its sections, and the period or time rate of change of the current. It may be observed, however, that these several factors—the capacity, the self-induction, resistance, and period—are all related in a manner well understood by electricians; but to render such conversion as may be effected by condensers practically available and useful it is desirable, chiefly on account of the increased output and efficiency and reduced cost of the apparatus, to produce current-impulses succeeding each other with very great rapidity, or, in other words, to render the duration of each impulse, alternation, or oscillation of the current extremely small. To the many difficulties in the way of effecting this mechanically, as by means of rotating switches or interrupters, is perhaps due the failure to realize practically, at least to any marked degree, the advantages of which such a system is capable. To obviate these difficulties, I have in my present invention taken advantage of the fact above referred to, and which has been long recognized, that if a condenser or a conductor possessing capacity be charged from a suitable source and be discharged through a circuit the discharge under certain conditions, dependent on the capacity of the condenser or conductor, the self-induction and resistance of the discharging circuit, and the rate of supply and decay of the electrical energy, may be effected intermittently or in the form of oscillations of extremely small period.

Briefly stated in general terms, the plan which I pursue in carrying out my invention is as follows:

I employ a generator, preferably, of very high tension and capable of yielding either direct or alternating currents. This generator I connect up with a condenser or conductor of some capacity and discharge the accumulated electrical energy disruptively through an air-space or otherwise into a working circuit containing translating devices and, when required, condensers. These discharges may be of the same direction or alternating and intermittent, succeeding each other more or less rapidly or oscillating to and fro with extreme rapidity. In the working circuit, by reason of the condenser action, the current impulses or discharges of high tension and small volume are converted into currents of lower tension and greater volume. The production and application of a current of such rapid oscillations or alternations (the number may be many millions per second) secures, among others, the following exceptional advantages: First, the capacity of the condensers for a given output is much diminished; second, the efficiency of the condensers is increased and the tendency to become heated reduced, and, third, the range of conversion is enlarged. I have thus succeeded in producing a system or method of conversion radically different from what has been done heretofore—first, with respect to the number of impulses, alternations, or oscillations of current per unit of time, and, second, with respect to the manner in which the impulses are obtained. To express this result, I define the working current as one of an excessively small period or of an excessively large number of impulses or alternations or oscillations per unit of time, by which I mean not a thousand or even twenty or thirty thousand per second, but many-times that number, and one which is made intermittent, alternating, or oscillating of itself without the employment of mechanical devices.

I now proceed to an explanation somewhat more in detail of the nature of my invention, referring to the accompanying drawings.

The two figures are diagrams, each representing a generating-circuit, a working circuit, means for producing an intermittent or oscillating discharge, and condensers arranged or combined as contemplated by my invention.

In Figure I, A represents a generator of high tension; B B, the conductors which lead out from the same. To these conductors are connected the conductors C of a working circuit containing translating devices, such as incandescent lamps or motors G. In one or both conductors B is a break D, the two ends being separated by an air-space or a film of insulation, through which a disruptive discharge takes place. F is a condenser, the plates of which are connected to the generating-circuit. If this circuit possess itself sufficient capacity, the condenser F may be dispensed with.

In Fig. 2 the generating-circuit B B contains a condenser F and discharges through the air-gaps D into the working circuit C, to any two points of which is connected a condenser E. The condenser E is used to modify the current in any part of the working circuit, such as L.

It may conduce to a better understanding of the invention to consider more in detail the conditions existing in such a system as is illustrated in Fig. I. Let it be assumed, therefore, that in the system there shown the rate of supply of the electrical energy, the capacity, self-induction, and the resistance of the circuits are so related that a disruptive, intermittent, or oscillating discharge occurs at D. Assume that the first-named takes place. This will evidently occur when the rate of supply from the generator is not adequate to the capacity of the generator, conductors B B, and condenser F. Each time the condenser F is charged to such an extent that the potential or accumulated charge overcomes the dielectric strength of the insulating-space at D the condenser is discharged. It is then recharged from the generator A, and this process is repeated in more or less rapid succession. The discharges will follow each other the more rapidly the more nearly the rate of supply from the generator equals the rate at which the circuit including the generator is capable of taking up and getting rid of the energy. Since the resistance and self-induction of the working circuit C and the rapidity of the successive discharges may be varied at will, the current strength in the working and generating circuit may bear to one another any desired relation.

To understand the action of the local condenser E in Fig. 2, let a single discharge be first considered. This discharge has two paths offered—one to the condenser E, the other through the part L of the working circuit C. The part L, however, by virtue of its self-induction, offers a strong opposition to such a sudden discharge, while the condenser, on the other hand, offers no such opposition. The result is that practically no current passes at first through the branch L, but presumably opposite electricities rush to the condenser-coatings, this storing for the moment electrical energy in the condenser. Time is gained by this means, and the condenser then discharges through the branch L, this process being repeated for each discharge occurring at D. The amount of electrical energy stored in the condenser at each charge is dependent upon the capacity of the condenser and the potential of its plates. It is evident, therefore, that the quicker the discharges succeed each other the smaller for a given output need be the capacity of the condenser and the greater is also the efficiency of the condenser. This is confirmed by practical results.

The discharges occurring at D, as stated, may be of the same direction or may be alternating, and in the former case the devices contained in the working circuit may be traversed by currents of the same or alternately-opposite direction. It may be observed, however, that each intermittent discharge occurring at D may consist of a number of oscillations in the working circuit or branch L.

A periodically-oscillating discharge will occur at D in Fig. 1 when the quantities concerned bear a certain relation expressed in well-known formulæ and ascertained by simple experiment. In this case it is demonstrated in theory and practice that the ratio of the strength of the current in the working to that in the generating circuits is the greater the greater the self-induction, and the smaller the resistance of the working circuit the smaller the period of oscillation.

I do not limit myself to the use of any specific forms of the apparatus described in connection with this invention nor to the precise arrangement of the system with respect to its details herein shown. In the drawings return-wires are shown in the circuit; but it will be understood that in any case the ground may be conveniently used in lieu of the return-wire.

What I claim is—

1. The method of electrical conversion herein described, which consists in charging a con-

denser or conductor possessing capacity and maintaining a succession of intermittent or oscillating disruptive discharges of said conductor into a working circuit containing translating devices.

2. In a system of electrical conversion, the combination of a generator or source of electricity and a line or generating circuit containing a condenser or possessing capacity, and a working circuit operatively connected with the generating-circuit through one or more air-gaps or breaks in the conducting medium, the electrical conditions being so adjusted that an intermittent or oscillating disruptive discharge from the generating into the working circuit will be maintained, as set forth.

NIKOLA TESLA.

Witnesses:
ROBT. F. GAYLORD,
PARKER W. PAGE.

(No Model.) 2 Sheets—Sheet 1.

N. TESLA.

METHOD OF REGULATING APPARATUS FOR PRODUCING CURRENTS OF HIGH FREQUENCY.

No. 568,178. Patented Sept. 22, 1896.

Fig. 1.

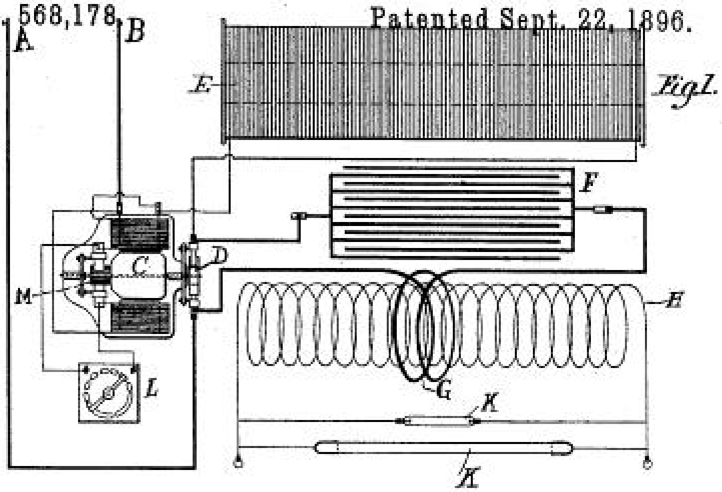
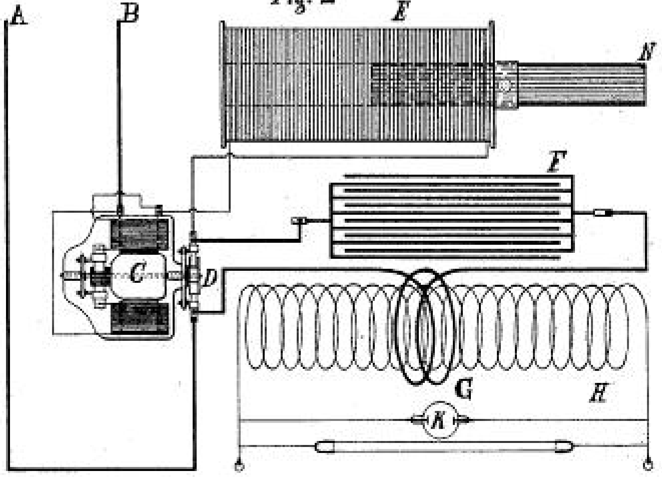


Fig. 2



WITNESSES

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INVENTOR

Nikola Tesla

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Kerr, Curtis & Page

ATTORNEYS

(No Model.) 2 Sheets—Sheet 2.

N. TESLA.

METHOD OF REGULATING APPARATUS FOR PRODUCING CURRENTS OF HIGH FREQUENCY.

No. 568,178. Patented Sept. 22, 1896.

Fig. 3.

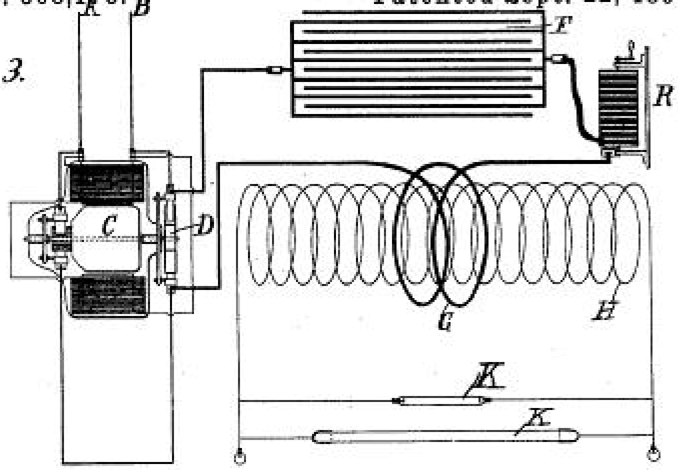
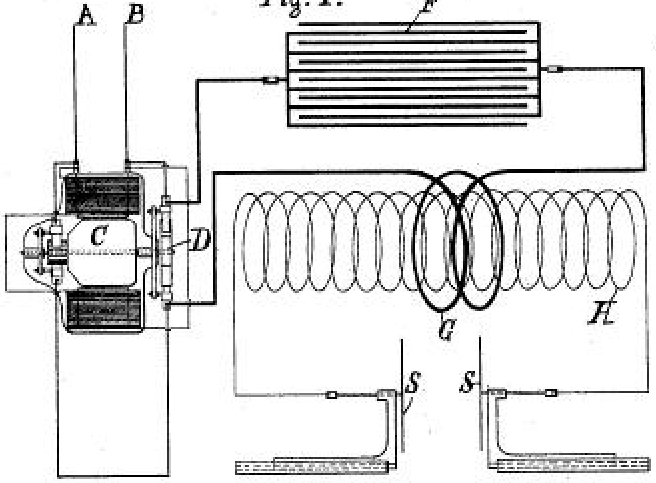


Fig. 4.



WITNESSES

Edwin B. Hopkinson,

M. Lawson Dyer.

INVENTOR

Nikola Tesla

BY

Kerr, Curtis & Page

ATTORNEYS

UNITED STATES PATENT OFFICE.

NIKOLA TESLA, OF NEW YORK, N. Y.

METHOD OF REGULATING APPARATUS FOR PRODUCING CURRENTS OF HIGH FREQUENCY.

SPECIFICATION forming part of Letters Patent No. 568,178, dated September 22, 1896.

Application filed June 20, 1896. Serial No. 596,262. (No model.)

To all whom it may concern:

Be it known that I, NIKOLA TESLA, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Methods of Regulating Apparatus for Producing Currents of High Frequency, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

In previous patents and applications I have shown and described a method of and apparatus for generating electric currents of high frequency suitable for the production of various novel phenomena, such as illumination by means of vacuum-tubes, the production of ozone, Roentgen shadows, and other purposes. The special apparatus of this character which I have devised for use with circuits carrying currents in the nature of those classed as direct, or such as are generally obtainable from the ordinary circuits used in municipal systems of incandescent lighting, is based upon the following principles:

The energy of the direct-current supply is periodically directed into and stored in a circuit of relatively high self-induction, and in such form is employed to charge a condenser or circuit of capacity, which, in turn, is caused to discharge through a circuit of low self-induction containing means whereby the intermittent current of discharge is raised to the potential necessary for producing any desired effect.

Considering the conditions necessary for the attainment of these results, there will be found, as the essential elements of the system, the supply-circuit, from which the periodic impulses are obtained, and what may be regarded as the local circuits, comprising the circuit of high self-induction for charging the condenser and the circuit of low self-induction into which the condenser discharges and which itself may constitute the working circuit, or that containing the devices for utilizing the current, or may be inductively related to a secondary circuit which constitutes the working circuit proper. These several circuits, it will be understood, may be more or less interconnected; but for purposes of illustration they may be regarded as practically distinct, with a circuit-controller for alternately connecting the condenser with the circuit by which it is charged and with that into which it discharges, and with a primary of a transformer in the latter circuit having its secondary in that which contains the devices operated by the current.

To this system or combination the invention, subject of my present application, pertains, and has for its object to provide a proper and economical means of regulation therefor.

It is well known that every electric circuit, provided its ohmic resistance does not exceed certain definite limits, has a period of vibration of its own analogous to the period of vibration of a weighted spring. In order to alternately charge a given circuit of this character by periodic impulses impressed upon it and to discharge it most effectively, the frequency of the impressed impulses should bear a definite relation to the frequency of vibration possessed by the circuit itself. Moreover, for like reasons the period or vibration of the discharge-circuit should bear a similar relation to the impressed impulses or the period of the charging-circuit. When the conditions are such that the general law of harmonic vibrations is followed, the circuits are said to be in resonance or in electromagnetic synchronism, and this condition I have found in my system to be highly advantageous. Hence in practice I adjust the electrical constants of the circuits so that in normal operation this condition of resonance is approximately attained. To accomplish this, the number of impulses of current directed into the charging-circuit per unit time is made equal to the period of the charging-circuit itself, or, generally, to a harmonic thereof, and the same relations are maintained between the charging and discharge circuit. Any departure from this condition will result in a decreased output, and this fact I take advantage of in regulating such output by varying the frequencies of the impulses or vibrations in the several circuits.

Inasmuch as the period of any given circuit depends upon the relations of its resistance, self-induction, and capacity, a variation of any one or more of these may result in a variation in its period. There are therefore various ways in which the frequencies of vibration of the several circuits in the system referred to may be varied, but the most practicable and efficient ways of accomplishing the desired result are the following: (*a*) varying the rate of the impressed impulses of current, or those which are directed from the source of supply into the charging-circuit, as by varying the speed of the commutator or other circuit-controller; (*b*) varying the self-induction of the charging-circuit; (*c*) varying the self-induction or capacity of the discharge-circuit.

To regulate the output of a single circuit which has no vibration of its own by merely varying its period would evidently require, for any extended range of regulation, a very wide range of variation of period; but in the system described a very wide range of regulation of the output may be obtained by a very slight change of the frequency of one of the circuits when the above-mentioned rules are observed.

In illustration of my invention I have shown by diagrams in the accompanying drawings some of the more practicable means for carrying out the same. The figures, as stated, are diagrammatic illustrations of the system in its typical form provided with regulating devices of different specific character. These diagrams will be described in detail in their order.

In each of the figures, A B designate the conductors of a supply-circuit of continuous current; C, a motor connected therewith in any of the usual ways and driving a current-controller D, which serves to alternately close the supply-circuit through the motor or through a self-induction coil E and to connect such motor-circuit with a condenser F, the circuit of which contains a primary coil G, in proximity to which is a secondary coil H, serving as the source of supply to the working circuit, or that in which are connected up the devices K K for utilizing the current.

The circuit-controller, it may be stated, is any device which will permit of a periodic charging of the condenser F by the energy of the supply-circuit and its discharging into a circuit of low self-induction supplying directly or indirectly the translating devices. Inasmuch as the source of supply is generally of low potential, it is undesirable to charge the condenser directly therefrom, as a condenser of large capacity will in such cases be required. I therefore employ a motor of high self-induction, or in place of or in addition to such motor a choking or self-induction coil E, to store up the energy of the supply-current directed into it and to deliver it in the form of a high-potential discharge when its circuit is interrupted and connected to the terminals of the condenser.

In order to secure the greatest efficiency in a system of this kind, it is essential, as I have before stated, that the circuits, which, mainly as a matter of convenience, I have designated as the "charging" and the "discharge" circuits, should be approximately in resonance or electromagnetic synchronism. Moreover, in order to obtain the greatest output from a given apparatus of this kind, it is desirable to maintain as high a frequency as possible.

The electrical conditions, which are now well understood, having been adjusted to secure, as far as practical considerations will permit, these results, I effect the regulation of the system by adjusting its elements so as to depart in a greater or less degree from the above conditions with a corresponding variation of output. For example, as in Figure 1, I may vary the speed of the motor, and consequently of the controller, in any suitable manner, as by means of a rheostat L in a shunt to such motor or by shifting the position of the brushes on the main commutator M of the motor or otherwise. A very slight variation in this respect, by disturbing the relations between the rate of impressed impulses and the vibration of the circuit of high self-induction into which they are directed, causes a marked departure from the condition of resonance and a corresponding reduction in the amount of energy delivered by the impressed impulses to the apparatus.

A similar result may be secured by modifying any of the constants of the local circuits, as above indicated. For example, in Fig. 2 the choking-coil E is shown as provided with an adjustable core N, by the movement of which into and out of the coil the self-induction, and consequently the period of the circuit containing such coil, may be varied.

As an example of the way in which the discharge-circuit, or that into which the condenser discharges, may be modified to produce the same result I have shown in Fig. 3 an adjustable self-induction coil R in the circuit with the condenser, by the adjustment of which the period of vibration of such circuit may be changed.

The same result would be secured by varying the capacity of the condenser; but if the condenser were of relatively large capacity this might be an objectionable plan, and a more practicable method is to employ a variable condenser in the secondary or working circuit, as shown in Fig. 4. As the potential in this circuit is raised to a high degree, a condenser of very small capacity may be employed, and if the two circuits, primary and secondary, are very intimately and closely connected the variation of capacity in the secondary is similar in its effects to the variation of the capacity of the condenser in the primary. I have illustrated as a means well adapted for this purpose two metallic plates S S, adjustable to and from each other and constituting the two armatures of the condenser.

I have confined the description herein to a source of supply of direct current, as to such the invention more particularly applies, but it will be understood that if the system be supplied by periodic impulses from any source which will effect the same results the regulation of the system may be effected by the method herein described, and this my claims are intended to include.

What I claim is—

1. The method of regulating the energy delivered by a system for the production of high-frequency currents and comprising a supply-circuit, a condenser, a circuit through which the same discharges and means for controlling the charging of the condenser by the supply-circuit and the discharging of the same, the said method consisting in varying the relations of the frequencies of the impulses in the circuits comprising the system, as set forth.

2. The method of regulating the energy delivered by a system for the production of high-frequency currents comprising a supply-circuit of direct currents, a condenser adapted to be charged by the supply-circuit and to discharge through another circuit, the said method consisting in varying the frequency of the impulses of current from the supply-circuit, as set forth.

3. The method of producing and regulating electric currents of high frequency which consists in directing impulses from a supply-circuit into a charging-circuit of high self-induction, charging a condenser by the accumulated energy of such charging-circuit, discharging the condenser through a circuit of low self-induction, raising the potential of the condenser discharge and varying the relations of the frequencies of the electrical impulses in the said circuits, as herein set forth.

NIKOLA TESLA.

Witnesses:
M. LAWSON DYER,
DRURY W. COOPER.

March 19, 1968 R. KROMREY 3,374,376

ELECTRIC GENERATOR

Filed Jan. 3, 1964 5 Sheets-Sheet 1

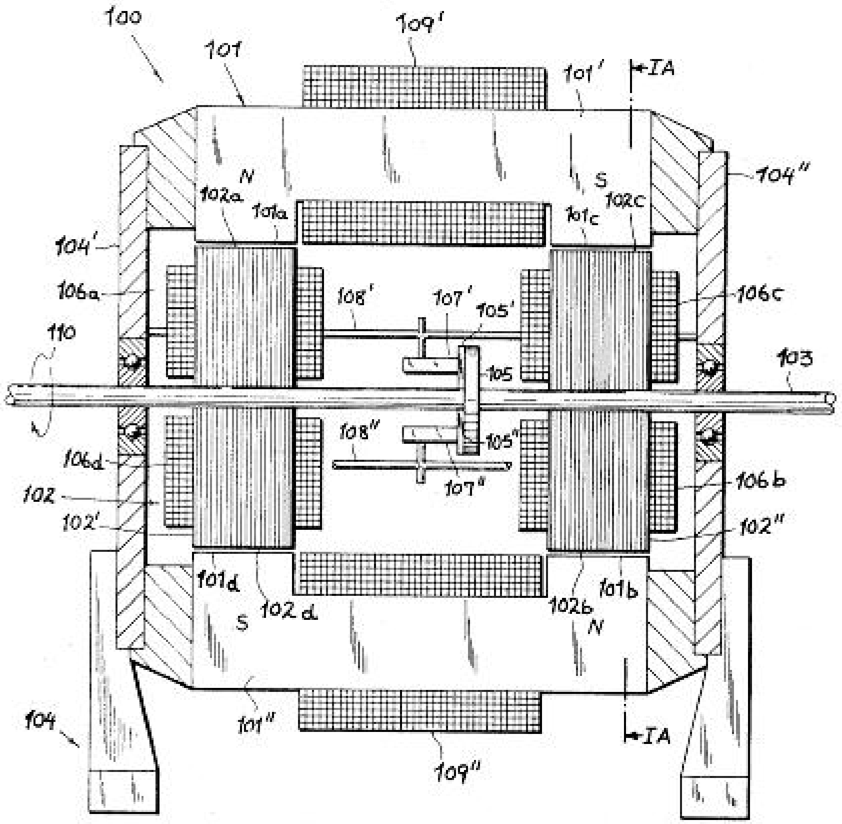


Fig.1

RAYMOND KROMREY
INVENTOR.

BY

AGENT

March 19, 1968 R. KROMREY **3,374,376**

ELECTRIC GENERATOR

Filed Jan. 9, 1964 5 Sheets-Sheet 2

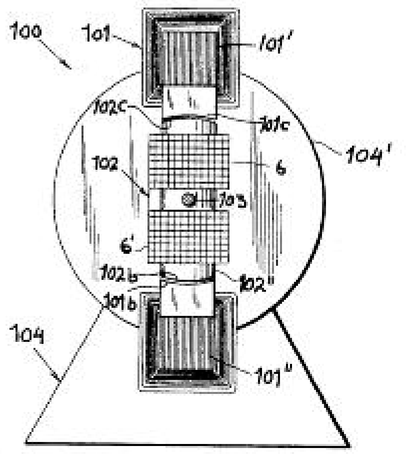


Fig.1A

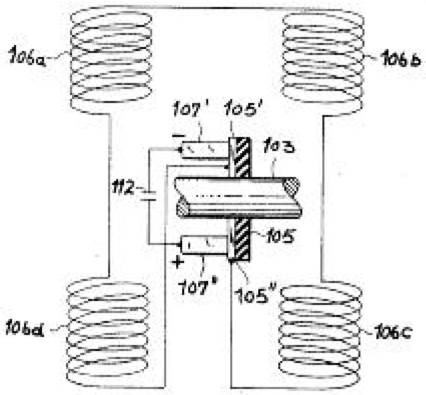


Fig.4

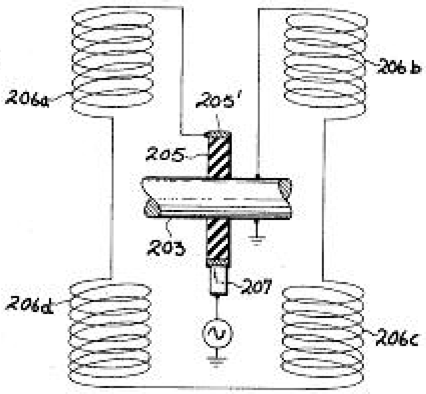


Fig.5

INVENTOR
RAYMOND KROMREY

BY

Karl G.

AGENT

March 19, 1968 R. KROMREY 3,374,376

ELECTRIC GENERATOR

Filed Jan. 9, 1964 5 Sheets-Sheet 3

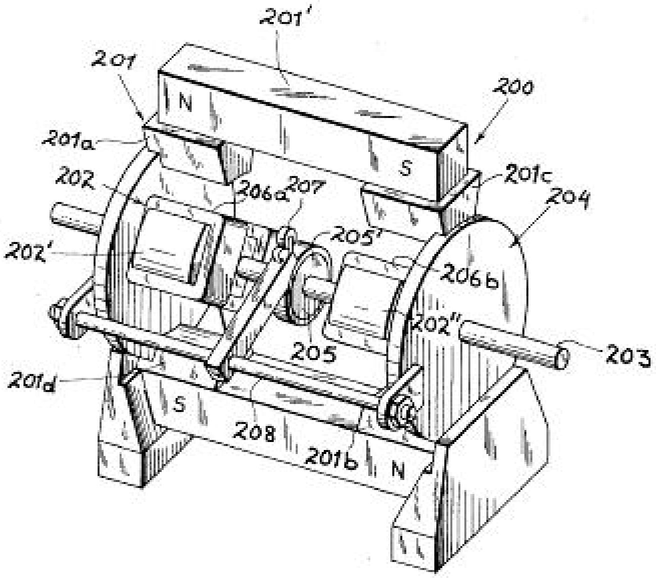


Fig.2

RAYMOND KROMREY
INVENTOR.

BY

Karl G. Ross
AGENT

March 19, 1968 R. KROMREY **3,374,376**

ELECTRIC GENERATOR

Filed Jan. 3, 1964 5 Sheets-Sheet 4

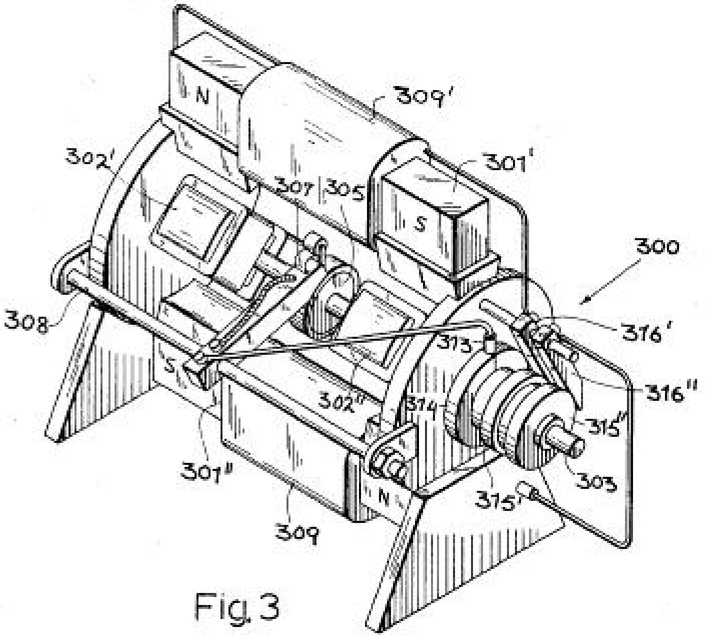


Fig. 3

RAYMOND KROMREY
INVENTOR.

BY Karl G. Ross
AGENT

March 19, 1968 R. KROMREY **3,374,376**

ELECTRIC GENERATOR

Filed Jan. 9, 1964 5 Sheets-Sheet 5

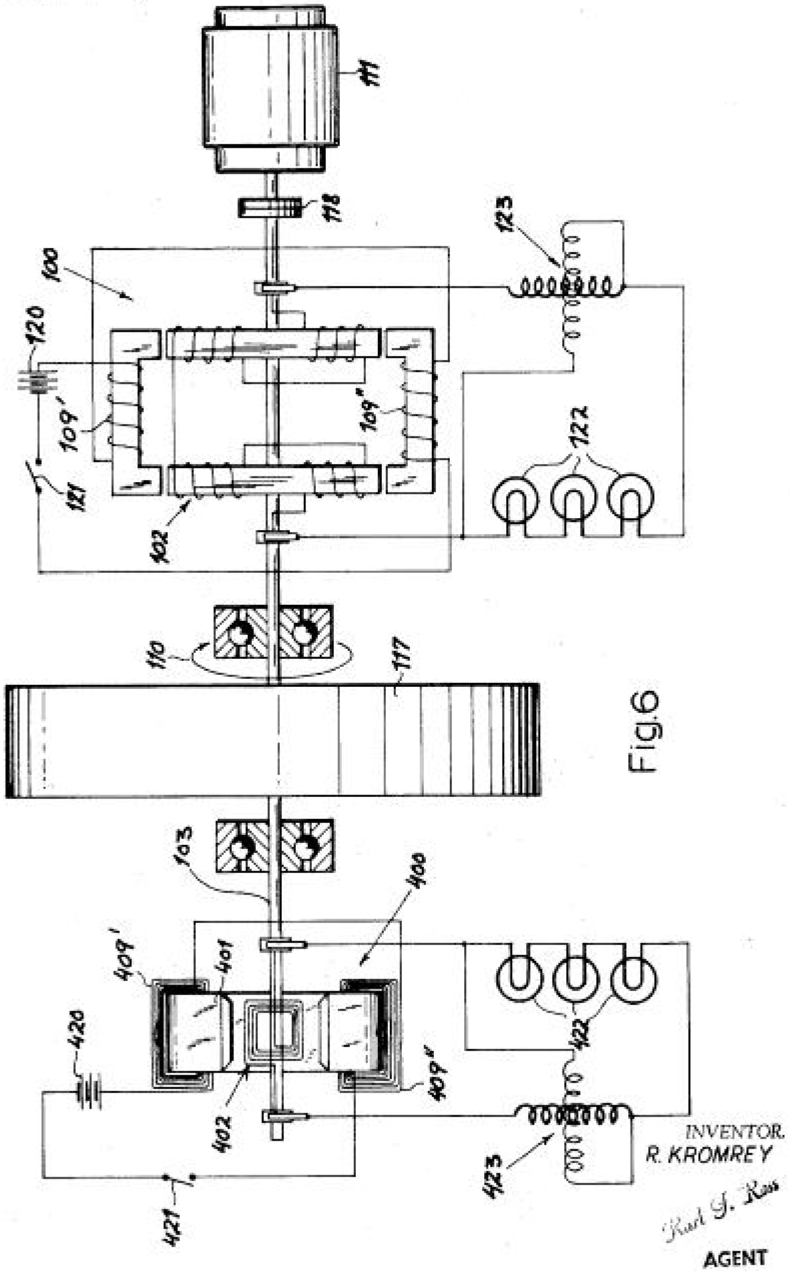


Fig.6

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United States Patent Office

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ELECTRIC GENERATOR

Raymond Kromrey, 15 Rue du Mt. Blanc,
Geneva, Switzerland
Filed Jan. 9, 1964, Ser. No. 336,769
1 Claim. (Cl. 310—112)

My present invention relates to an electric generator serving to convert magnetic force into electric energy with the aid of two relatively rotatable members, i.e. a stator and a rotor, one of these members being provided with electromagnetic or permanent-magnetic means adapted to induce a voltage in a winding forming part of an output circuit on the other member.

Conventional generators of this type utilize a winding whose conductors form loops in different axial planes whereby, upon relative rotation of the two members, diametrically opposite portions of each loop pass twice per revolution through the field of each pole pair of the magnetic inductor member (usually the stator). If the loops are open-circuited, no current flows in the winding and no reaction torque is developed so that the rotor will be free to turn at the maximum speed of its driving unit. As soon as the output circuit including the winding is short-circuited or connected across a load, the resulting current flow tends to retard the motion of the rotor to an extent dependent upon the magnitude of the current, it being therefore necessary to provide compensating speed-regulating devices if it is desired to maintain a substantially constant terminal voltage. Moreover, the variable reaction torque subjects the rotor and its transmission to considerable mechanical stresses which, in the case of widely fluctuating load currents, may lead to objectionable strains.

It is, therefore, the general object of my present and new invention to provide an electric generator which obviates the aforedescribed disadvantages.

A more particular object of my invention is to provide a generator of such construction that its reaction torque and, therefore, its rotor speed in response to a given driving torque varies but little upon changeover from open circuit to current delivery or vice versa.

It is also an object of this invention to provide an electric generator whose terminal voltage varies at a considerably lesser rate than its rotor speed so as to be less affected than conventional generators by fluctuations of its driving rate.

I have found, in accordance with this invention, that the foregoing objects can be realized by the relative rotation of an elongated ferromagnetic element, such as a bar-shaped soft-iron armature, and a pair of pole pieces defining an air gap wherein a magnetic field is set up under the influence of a suitable source of coercive force. The armature carries a winding, advantageously in the form of two series-connected coils embracing opposite extremities thereof, which is included in an output circuit adapted to be connected to a load. As the armature rotates within the stationary air gap (or, conversely, the pole pieces swing about the stationary armature), the magnetic circuit is intermittently completed and the armature experiences periodic remagnetizations with successive reversals of polarity.

When the output circuit is open, the mechanical energy applied to the driven rotor member is converted, to the extent that it is not needed to overcome frictional resistance, into work of magnetization which in turn is dissipated as heat; in actual practice, however, the resultant rise in the temperature of the armature will be hardly noticeable, particularly if the armature is part of the continuously air-cooled rotor assembly. When the output circuit is closed, part of this work is translated into electrical energy as the current flow through the winding opposes the magnetizing action of the field and increases the apparent magnetic reluctance of the armature. This explains why, in a system embodying my invention, the speed of the generator remains substantially unchanged when the output circuit is either opened or closed.

As the armature approaches its position of alignment with the gap, the constant magnetic field existing thereacross tends to accelerate the rotation of the armature relative to the pole pieces, thereby aiding the applied driving torque; the opposite action, i.e. a retarding effect, occurs after the armature passes through its aligned position. As the rotor attains a certain speed, however, the flywheel effect of its mass overcomes these fluctuations in the total applied torque so that a smooth rotation ensues.

In a practical embodiment, according to a more specific feature of my invention, the magnetic-flux path includes two axially spaced magnetic fields traversing the rotor axis substantially at right angles, these fields being generated by respective pole pairs co-operating with two axially spaced armatures of the character described. It will generally be convenient to arrange the two armatures in a common axial plane, the two field-producing pole pairs being similarly coplanar. The armatures are preferably of the laminated type to minimize the flow of eddy currents therein; thus, they may consist in essence of highly permeable (e.g. soft-iron) foils whose principal dimension is perpendicular to the rotor axis, the foils being held together by rivets or other suitable fastening means.

If the ferromagnetic elements are part of the rotor, the output circuit will include the usual current-collecting means, such as slip rings or commutator segments, according to whether alternating or direct current is desired. The source of coercive force in the stator includes, advantageously, a pair of oppositely disposed yoke-shaped magnets, of the permanent or the electrically energized type, whose extremities constitute the aforementioned pole pieces. If electromagnets are used in the magnetic circuit, they may be energized by an external source or by direct current from the output circuit of the generator itself.

I have found that the terminal voltage of the output circuit of a generator according to the invention does not vary proportionately to the rotor speed, as might be expected, but drops at a considerably slower rate with decreasing speed of rotation; thus, in a particular unit tested, this voltage fell only to about half its original value upon a cutting of the rotor speed to one-third. This nonlinear relationship between terminal voltage and driving rate enables the maintenance of a substantially constant load current and, therefore, electric output over a wide speed range, at least under certain load conditions, inasmuch as the inductive reactance of the winding is proportional to frequency (and consequently to rotor speed) so as to drop off more rapidly than the terminal voltage, in the event of a speed reduction, with a resulting improvement in the power factor of the load circuit.

If the magnetic circuit includes but a single pole pair per air gap, the flux induced in the relatively rotating armature will change its direction twice per revolution so that each revolution produces one complete cycle of 360 electrical degrees. In general, the number of electrical degrees per revolution will equal 360 times the number of pole pairs, it being apparent that this number ought to be odd since with even numbers it would not be possible to have poles alternating in polarity along the path of the armature and also to have the north and south poles of each pair at diametrically opposite locations. In any case it is important to dimension the confronting arcuate faces of the pole pairs in such manner as to avoid bridging of adjoining poles by the armature, hence it behooves to make the sum of the arcs spanned by these faces (in the plane of rotation) equal to considerably less than 360° electrical.

The invention will be described hereinafter with greater detail, reference being made to the accompanying drawing in which:

FIGS. 1 and 1A illustrate a first embodiment of my invention in axial section and in a cross-sectional view taken on line 1A—1A of FIG. 1, respectively;

FIGS. 2 and 3 are perspective views illustrating two further embodiments;

FIGS. 4 and 5 diagrammatically illustrate two output circuits for a generator according to the invention, designed respectively for direct and alternating current; and

FIG. 6 is a somewhat diagrammatic illustration of an arrangement for comparing the outputs of a conventional generator and a generator according to the invention.

The generator **100** shown in FIGS. 1 and 1A comprises a stator member **101** and a rotor member **102**, the latter comprising a pair of laminated armatures **102′**, **102″** carried on a shaft **103** which is rotatably journaled in end plates **104′**, **104″** of a generator housing **104** of nonmagnetic material (e.g. aluminum) rigid with the stator. Shaft **103** is coupled with a source of driving power indicated diagrammatically by an arrow **110**.

The stator **101** includes a pair of yoke-shaped laminated electromagnets **101′**, **101″** whose extremities form two pairs of coplanar pole pieces respectively designated **101*a***, **101*b*** (north) and **101*c***, **101*d*** (south). The pole pieces have concave faces confronting complementarily convex faces **102*a***, **102*d*** of armature **102′** and **102*b***, **102*c*** of armature **102″**. These faces, whose concavities are all centered on the axis of shaft **103**, extend over arcs of approximately 20 to 25° each in the plane of rotation (FIG. 1A) so that the sum of these arcs adds up to about 90° geometrical and electrical.

The magnets **101′**, **101″** of the stator are surrounded by respective energizing windings **109′**, **109″** which are connected across a suitable source of constant direct current, not shown. Similar windings, each composed of two series-connected coils **106*a***, **106*d*** and **106*b***, **106*c***, surround the rotor armatures **102′** and **102″**, respectively. These coils form part of an output circuit which further includes a pair of brushes **107′**, **107″** that are carried by arms **108′**, **108″** on housing **104** with mutual insulation; brushes **107′**, **107″** co-operate with a pair of commutator segments **105′**, **105″** (see also FIG. 4) which are supported by a disk **105** of insulating material on shaft **103**. By virtue of the series connection of coils **106*a*–106*d*** between the segments **105′** and **105″**, as illustrated in FIG. 4, the alternating voltage induced in these coils gives rise to a rectified output voltage at brushes **107′** and **107″**; the unidirectional current delivered by these brushes to a load (not shown) may be smoothed, in a manner known per se, by conventional filter means represented diagrammatically by a condenser **112** in FIG. 4.

In FIG. 2 I have shown a modified generator **200** whose housing **204** supports a stator **201** consisting essentially of two permanent bar magnets **201′** and **201″** extending parallel to the drive shaft **203** on opposite sides thereof, each of these magnets being rigid with a respective pair of pole shoes **201*a***, **201*c*** and **201*b***, **201*d***. Rotor **202** comprises a pair of laminated armatures **202′**, **202″**, similar to those of the preceding embodiment, whose output coils **206*a***, **206*b***, **206*c***, **206*d*** are serially connected between a slip ring **205′**, supported on shaft **203** through the intermediary of an insulating disk **205**, and another terminal here represented by the grounded shaft **203** itself. Slip ring **205′** is contacted by a brush **207** on a holder **208**, the output of this brush being an alternating current of a frequency determined by the rotor speed.

In FIG. 3 I have shown a generator **300** basically similar to generator **100** of FIGS. 1 and 1A, its shaft

303 carrying a pair of laminated soft-iron armatures **302′**, **302″** rotatable in the air gaps of a pair of electromagnets **301′**, **301″** bearing energizing windings **309′** and **309″**. The commutator **305** again co-operates with a pair of brushes of which only one, designated **307**, is visible in the figure. This brush, carried on an arm **308**, is electrically connected to a brush **313** engaging a slip ring **314** on an extremity of shaft **303** which also carries two further slip rings **315′**, **315″** in conductive contact with ring **314** but insulated from the shaft. Two further brushes **316′**, **316″** contact the rings **315′**, **315″** and are respectively connected to windings **309′** and **309″**, respectively, the other ends of these windings being connected to an analogous system of brushes and slip rings on the opposite shaft extremity whereby the two commutator brushes are effectively bridged across the windings **309′** and **309″** in parallel. In this embodiment, therefore, the stator magnets are energized from the generator output itself, it being understood that the magnets **301′** and **301″** (made, for example, of steel rather than soft iron) will have a residual coercive force sufficient to induce an intial output voltage as is known per se. Naturally, the circuits leading from the brushes **307** to the windings **309′**, **309″** may include filter means as described in connection with FIG. 4.

In FIG. 6 I have shown a test circuit designed to compare the outputs of a generator according to the invention, such as the unit **100** of FIGS. 1 and 1A, with a conventional generator **400** of the type having a looped armature **402** rotatable in a gap of a stator magnet **401** with energizing winding **409′**, **409″**. The two generators are interconnected by a common shaft **103** carrying a flywheel **117**, this shaft being coupled via a clutch **118** to a drive motor **111** whereby the rotors **402** and **102** of both generators are rotatable in unison as indicated by arrow **110**. Two batteries **120** and **420**, in series with switches **121** and **421**, are representative of means for supplying direct current to the stator windings **109′**, **109″** and **409′**, **409″** of the two generators.

The rectified output of generator **100** is delivered to a load **122**, here shown as three series-connected incandescent lamps with a combined consumption of 500 watts, generator **400** working into an identical load **422**. Two wattmeters **123** and **423** have their voltage and current windings respectively connected in shunt and in series with the associated loads **122** and **422** to measure the electric power delivered by each generator.

Upon engagement of the clutch **118**, shaft **103** with its flywheel **117** is brought to an initial driving speed of 1200 r.p.m. whereupon the switch **421** in the energizing circuit of conventional generator **400** is closed. The lamps **422** light immediately and the corresponding wattmeter **423** shows an initial output of 500 watts; this output, however, drops instantly as the flywheel **117** is decelerated by the braking effect of the magnetic field upon armature **402**.

Next, the procedure is repeated but with switch **421** open and switch **121** closed to energize the generator **100**. The lamps **122** light up and the wattmeter **123** shows an output of 500 watts which remains constant for an indefinite period, there being no appreciable deceleration of flywheel **117**. When the clutch **118** is released and the rotor speed gradually decreases, the output of generator **100** is still substantially 500 watts at a speed of 900 r.p.m. and remains as high as 360 watts when the speed drops further to 600 r.p.m.

In a similar test with a generator of the permanent-magnet type, such as the one shown at **200** in FIG. 2, a substantially constant output was observed over a range of 1600 to 640 r.p.m.

Modifications of the specific arrangements described and illustrated will, of course, be apparent to persons skilled in the art and are deemed to be embraced in the spirit and scope of my invention as defined in the appended claim.

I claim:

1. An electric generator comprising a fixed stator and a rotor coaxial with said stator; drive means for rotating said rotor about its axis, said stator being provided with a pair of elongated bar magnets extending parallel to said axis on opposite sides thereof and terminating in transverse extremities, oppositely poled extremities of said magnets confronting each other and defining magnet means having two axially spaced pole pairs disposed in a common axial plane and forming a pair of diametrically extending air gaps for establishing a magnetic-flux path including two axially spaced parallel magnetic fields across said air gaps traversing said axis substantially at right angles, said rotor being provided with two axially spaced parallel elongated ferromagnetic elements slightly shorter than the spacing of said confronting extremities and extending perpendicularly to said axis at locations coplanar with said pole pairs for concurrent periodic alignment of said elements with said fields in said air gaps upon rotation of said rotor; and an output circuit on said rotor including winding means on each of said elements and collector means in series with said winding means, each of said pole pairs and the corresponding elements having confronting arcuate faces centered on said axis, the sum of the arcs spanned by said faces being substantially equal to 90° in the plane of rotation.

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by Peter Lindemann and Aaron Murakami

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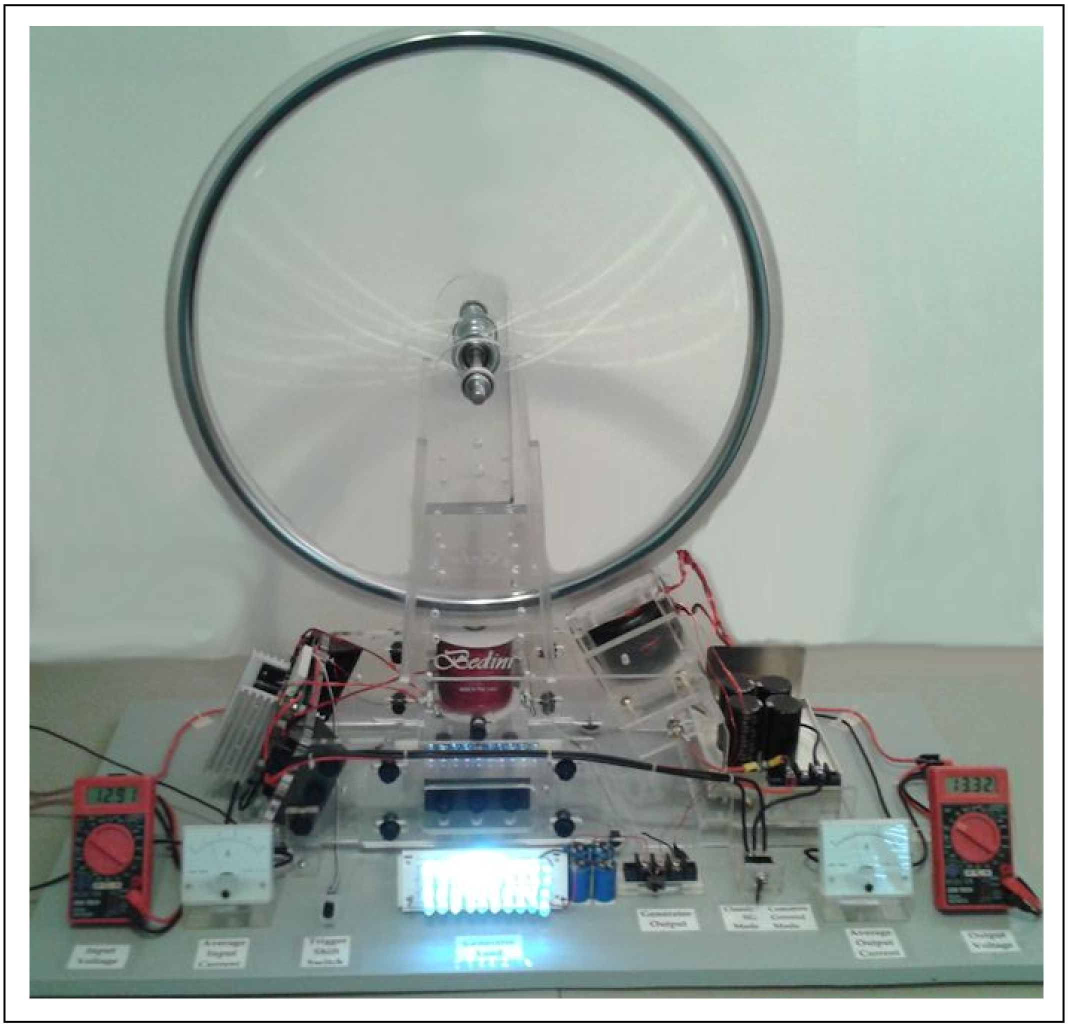
Bedini SG

The Complete Advanced Handbook

Optimizing Mechanical Recovery with a "Low-Drag" Generator



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Foreword

This book is the third and final book in the series of Bedini SG Handbooks. The full instructions on how to build the Bedini SG Energizer are in the first book titled **Bedini SG, the Complete Beginner's Handbook**. The full instructions on all of the fine-tuning methods and energy gain tricks are in the second book titled **Bedini SG, the Completer Intermediate Handbook**. If you are not familiar with these two previous books, then make sure to get them here so you can start from the beginning: http://bedinisg.com

This book reviews the fine tuning methods discussed in the Intermediate Handbook, and shows the operations of a working model where all of these features are optimized. It then goes on to discuss, in detail, the best ways to harness the mechanical energy available at the wheel, using "low-drag" generator methods. It also includes a complete analysis of the "Jim Watson" machine, putting the complete design, schematic, and operational details in print for the very first time.

This book picks up where the Intermediate Handbook leaves off and covers all of the major details and spin-offs from John Bedini's life-time search for the best design of a self-running, electro-mechanical machine.

After learning this material, you should understand enough of the science and method that John has shown to start experimenting with larger scale models which should lead to both self-running behavior and the production of enough extra energy to operate external loads.

The future is yours!

Peter Lindemann (August 2014)

Introduction

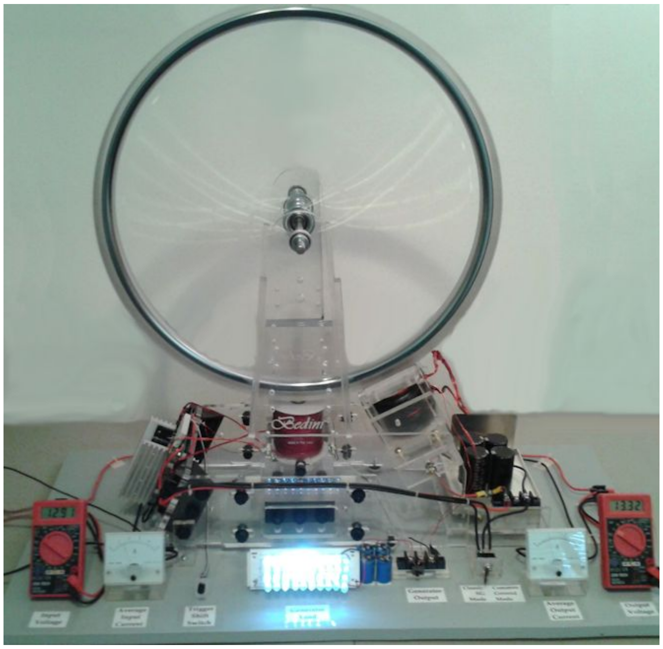
The purpose of this book is to demonstrate how the mechanical energy produced by a Bedini SG Energizer can be maximized, and how that mechanical energy can be converted back into the maximum quantity of electrical energy, so that a clear and unambiguous "energy gain" may be achieved.

This process involves:

1. using the "fine tuning" methods discussed in the Intermediate Handbook to produce the highest speed rotation of the rotor for the lowest electrical input from the run battery
2. as well as introducing a "low-drag" generator system to the wheel to take the highest possible advantage of that mechanical energy for the production of new electricity that did not come from the run battery in the first place

While John Bedini has demonstrated these methods repeatedly and published all of the basic schematics on how to accomplish this on his website since 1996, people still seem confused by this process. He believed that people needed to learn the process by actually building the equipment and therefore has never felt the need to fully explain it in words.

Since the demonstration of the "Ferris Wheel" machine in 2010, and the two previous **Bedini SG Handbooks** in 2012 and 2013, it seems possible that the release of this information will be tolerated by the forces in the economy that have resisted these things in the past. Therefore, everything is going to be explained clearly so that serious researchers may move their experiments forward.



A machine was demonstrated at the **2014 Energy Science and Technology Conference** that has all of the features you need to understand to build yourself a supplemental power plant for your off-grid home. This includes a "low-drag" generator whose features will be fully disclosed in Chapter 6.

This last installment of the **Bedini SG Handbook** series is the final unraveling of the mysteries of John's self-running machines, which have been "hidden in plain sight" for over 30 years.

Peter Lindemann, D.Sc.

Chapter One

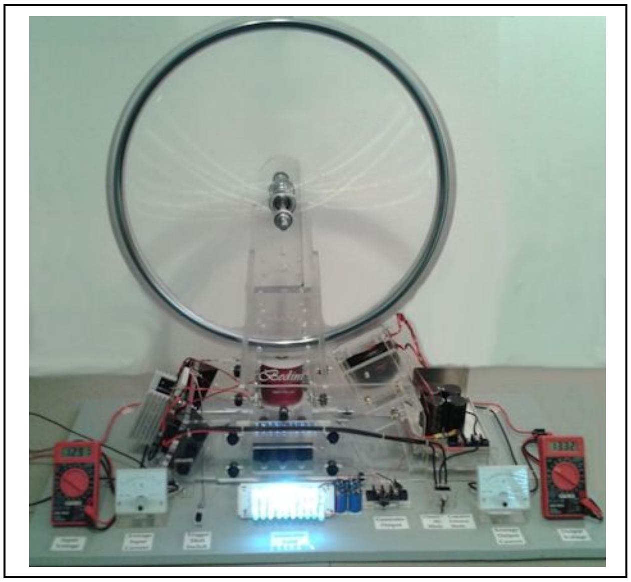
Intermediate SG Energizer Demo Review

The **Bedini SG, The Complete Intermediate Handbook** introduced and explained the benefits of many of John's "tricks." These tricks are really a series of very clever engineering procedures that allow a person "skilled in the art" to optimize the functions of the circuitry so that the machine may take advantage of a number of "windows of opportunity" to minimize energy losses and introduce some compensatory energy gains. The net result of these refinements increases the efficiency of the machine and unambiguously introduces the reader to the conditions necessary for "self-running" operation.

These refinements include the various methods to "fine tune" the operation of the Energizer, a complete historical review of all of the methods for providing a capacitor charge and discharge feature, and the advanced theory explaining why this produces a benefit based on Nikola Tesla's discovery of his "Method of Conversion" process.

As this book was being outlined in the Spring of 2014, it became necessary to build a working model of the optimized "Intermediate" energizer, so that the additional "low-drag" generator methods could be built and tested. This also made it possible to demonstrate this working model at the **2014 Energy Science and Technology Conference** at the end of June.

Here is a picture of that machine.

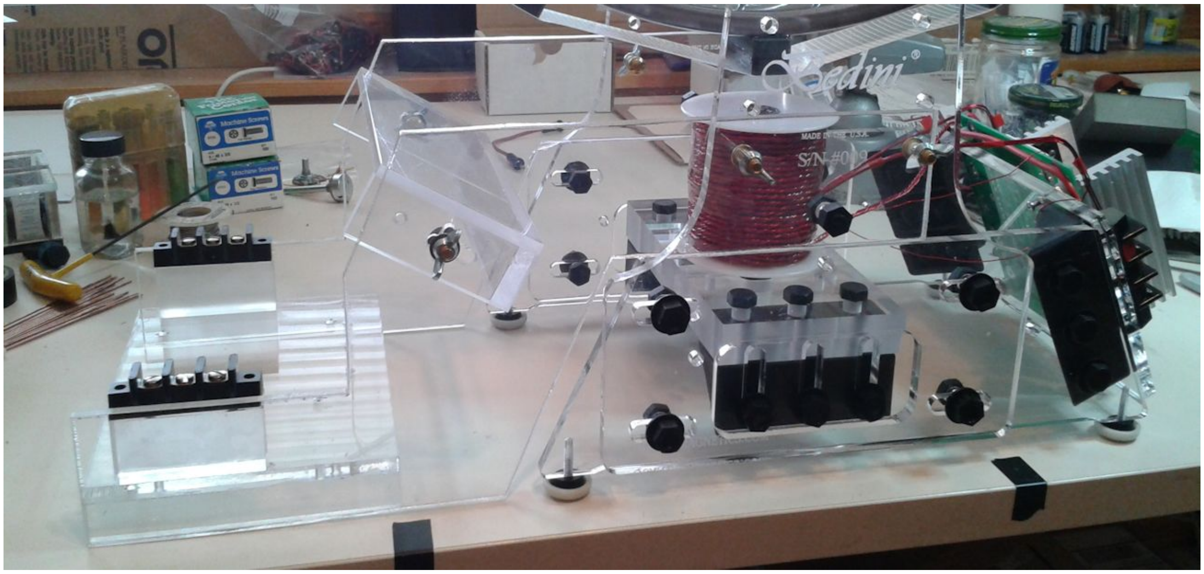


The Conference Demonstration Model

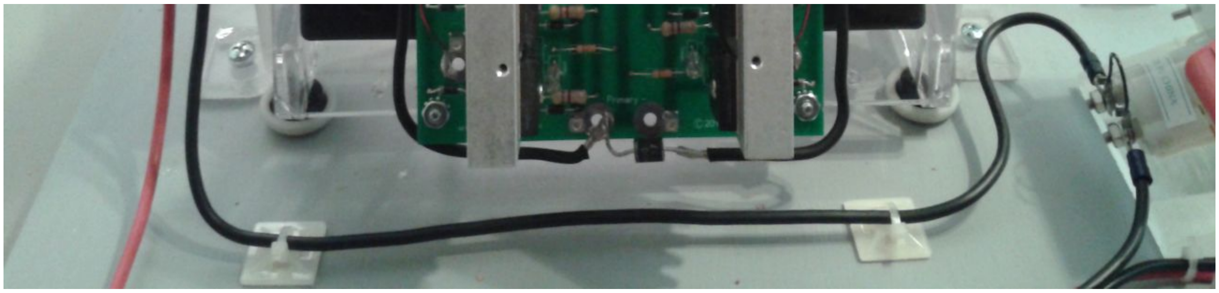
This machine had a number of features that you may not want to include in your replication. They include:

1. a frame built from clear acrylic
2. wiring suspended in the air
3. dedicated meters
4. labeled instrumentation

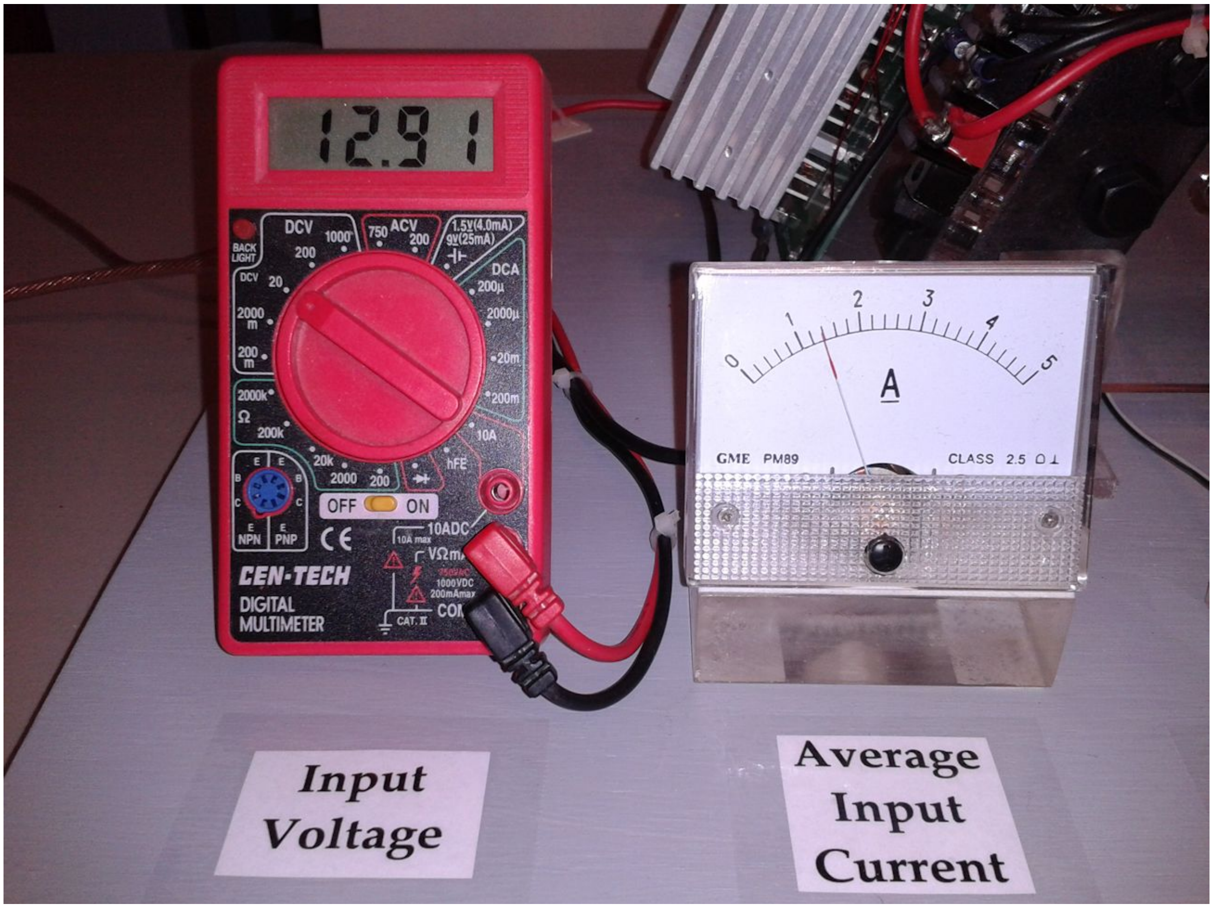
The clear acrylic frame was left over from the original SG Kit models that we sold for a short time in 2012. As a demonstration, it looked professional and it eliminated the arguments about whether anything was "hidden."



The wiring suspended in the air also negated the arguments about whether there may have been "secret connections" to otherwise unseen circuitry.



The dedicated meters were mounted on pieces of clear acrylic, again to reduce the skeptic's ability to "explain away" the meter readings. Also, the labeled meters, switches, and connections made the demonstration easy for the Conference attendees to understand what they were looking at.

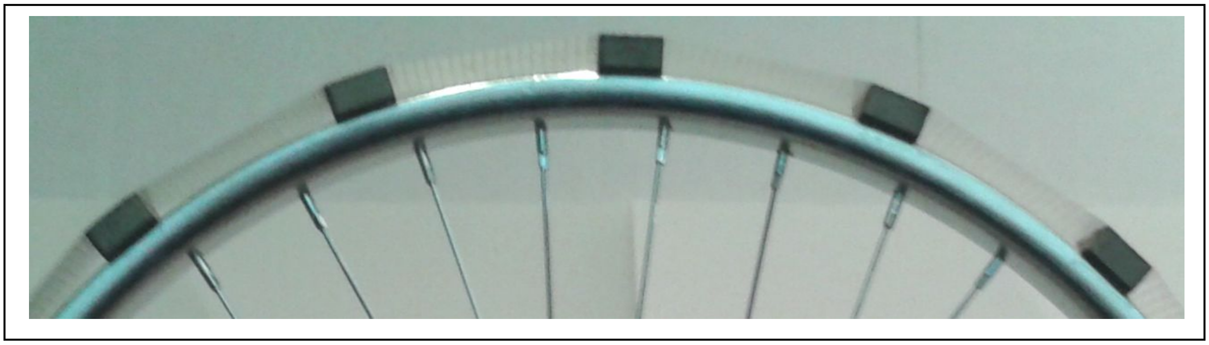


All of these features, produced at extra cost and time, created the intended effect. No one questioned the explanations of the operation of the machine at the Conference.

Significant Mechanical Up-grades

The SG Kits came with a bicycle wheel and shaft extensions that when combined, were never able to produce a wheel that ran true. This required major surgery. The frame bearings and internal wheel bearings and shaft were all abandoned and replaced with a new, larger diameter solid shaft and new bearings and sleeve guides to hold everything in place. With these materials installed, the hub of the wheel ran true.

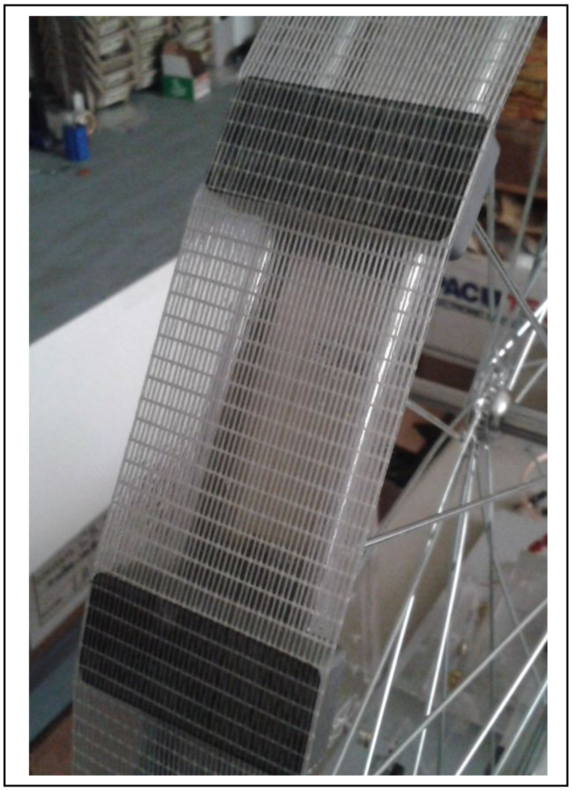
The next problem was the rim. With the hub running true, it was obvious how "out of round" the rim was. This required a laborious process of loosening and tightening the wheel spokes until all of the eccentricities were compensated. This took over an hour but was absolutely necessary.



Obviously, this step would not have needed to be done if a molded, plastic wheel had been used to begin with. Other model builders have used molded plastic wheels this size from wheel chairs or more modern bicycles.

Once both the hub and the rim were running true, the wheel was balanced and able to run at high speed without vibration. It could also run in a narrow slot between the frame pieces holding the generator coil in place.

The above picture also shows the magnet spacing chosen for this model. The wheel had 36 spokes, so by placing a magnet next to every other spoke, the number of magnets came out to be 18. This made magnet placement relatively easy and produced a run speed slightly higher than the 21 magnet arrangement used in the **SG Beginner's Handbook**.



Once the magnets were positioned on the metal rim and glued in place using a "super-glue" cyanoacrylate adhesive, it was time to secure them to the wheel for high speed operation.

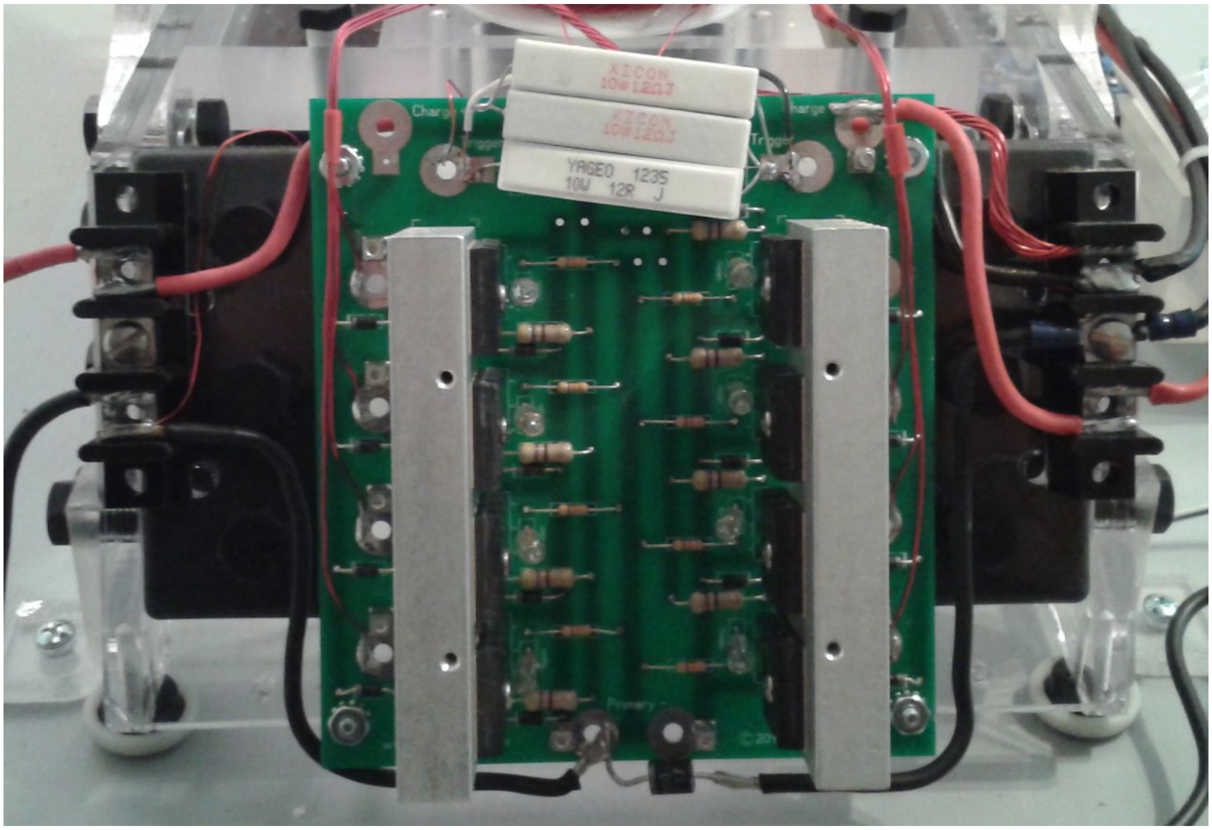
For this, two layers of a reinforced packing tape was used, wrapped firmly around the wheel twice. This type of tape is sometimes called "strapping tape" because of the imbedded fiber-glass netting. This feature makes the tape very resistant to either stretching or tearing under stress.

Cyanoacrylate adhesives are quite brittle after curing, and since this motor operates on an "attraction" mode, the magnetic field from the coil is trying to pull the magnets off of the wheel as they approach. With the reinforced tape in place, if the glue fails, a magnet will NOT fly across the room at 40 feet per second! Instead, you will just hear a "clicking" sound on the wheel as the magnet is pulled off of the rim slightly as it passes over the coil.

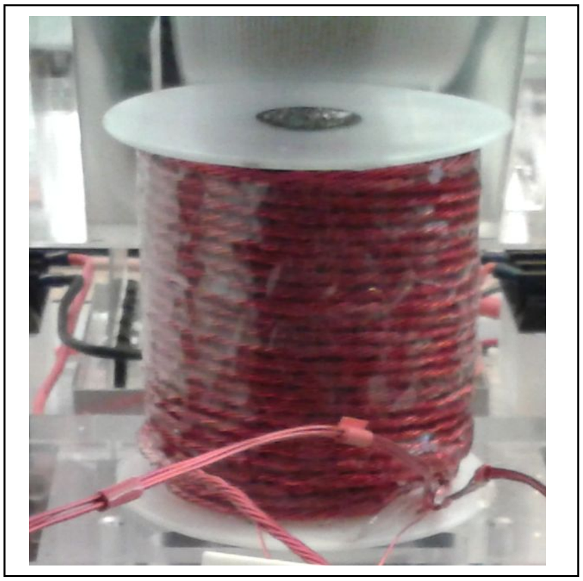
Electrical Circuit Features

When this model was coming together, a number of people very generously donated parts. John Bedini provided the plastic frame, wheel, magnets, and a prototype circuit board built by Tom Childs at Teslagenx. Tom then donated one of their fully wound coils with seven 20 gauge power windings and a 23 gauge trigger winding. Finally, Aaron Murakami donated the capacitor discharge circuit he had purchased earlier. Peter Lindemann took all of these parts and assembled and adjusted everything to produce the finished Demonstration Model.

For the electronic circuit, all of the "fine tuning" methods were employed. This included matched transistors and matched resistors and the circuit built on a clean circuit board. Anyone can build a circuit like this using the specifications in the **Bedini SG Intermediate Handbook**, or simply by purchasing a circuit like this from Teslagenx.



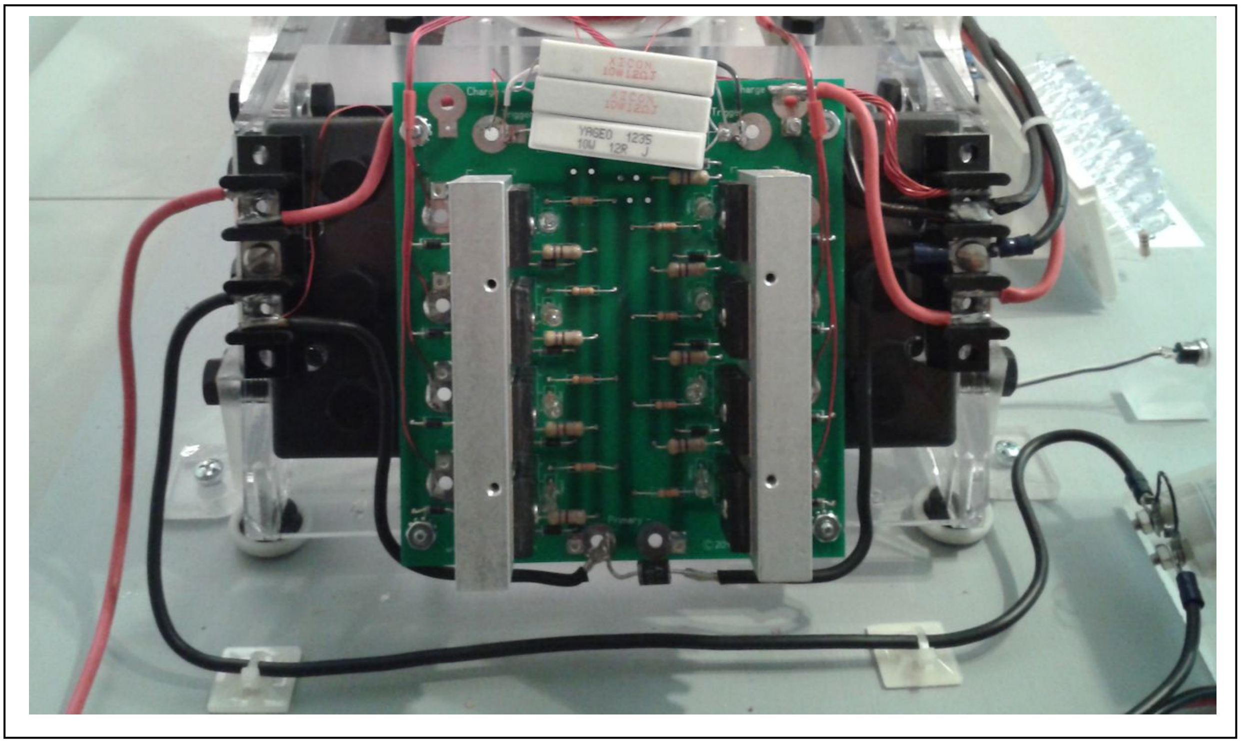
There are only two modifications made to this circuit board for this model. The first is that the single large 12 Ohm resistor (Yageo) at the top-center of the photo is joined by two more 12 Ohm resistors (Xicon) as part of the "fine tuning" of the trigger. This modification will be discussed in more detail shortly. The second modification is the large Diode at the bottom-center of the photo which is part of the "generator mode" circuitry which will be discussed later. Otherwise, this circuit board is exactly like the one you would get from Teslagenx.



The specifications for winding your own coil are in the **SG Beginner's Handbook**, but making the coil remains the most difficult task of building your own SG replication.

So don't feel bad if you want to just purchase this component. Here is a photo of the coil donated to this project and it represents proof that they work perfectly when incorporated into a really "fine tuned" model.

After the coil and the circuitry were in place, all of the temporary wiring was removed and replaced by 12 gauge wire, as shown here.



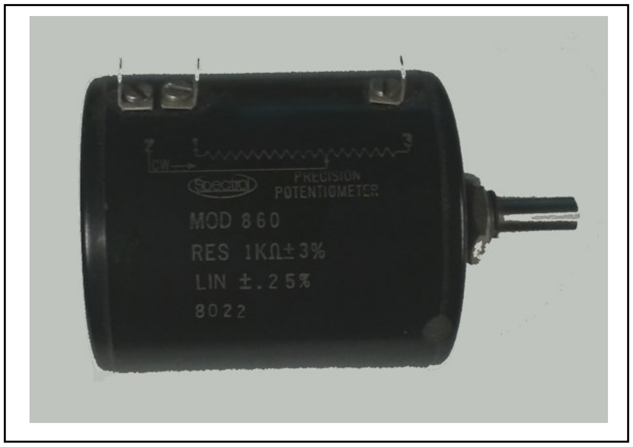
This is all of the larger **Red** and **Black** wires that connect between the batteries, meters, terminal blocks, and other sections of the circuit. When this operation was completed, the behavior of the machine changed dramatically! In short, it started running much better.

In order to understand why this happened, you have to remember that the Bedini SG is a "high frequency" machine. The transistors are rated at 16 Mhz and can easily turn off within a few microseconds. With this kind of switching speeds, it means that "every length of wire is an inductor" and that everything you can do to "lower the impedance of the circuit" will improve its performance. Many model builders neglect this step, but the benefits are significant and well worth installing.

Adjusting the Trigger Circuit

The next step was to "fine tune" the triggering function of the circuit. As you probably remember from the **SG Beginner's Handbook**, the current circulating in the trigger circuit is actually generated in the trigger winding by the permanent magnets moving passed the coil. That means that the distance between the coil and the wheel is one of the variables that contributes to the strength of that current.

So the first thing to do is to move the coil up or down from its original position until you find a height that produces the highest speed. In the case of this demonstration model, that distance ended up being 0.375" or 9.52 mm. [The **SG Beginner's Handbook** specified 0.125" on page 56.]



With the coil height set, the 12 Ohm resistor was disconnected from the circuit board and temporarily replaced by a 25 watt variable resistor. The machine was then brought up to full speed and the variable resistor was turned up and down until the highest speed could be maintained with the lowest current draw from the run battery, as shown on the Input Ammeter.

As it turned out, the value of the additional resistance needed for this condition in this model was 36 Ohms. So, when the variable resistor was removed, it was replaced by three 12 Ohm resistors wired in series, as shown on page 15.

After the three 12 Ohm resistors were soldered back on the circuit board, a curious thing happened. The next time the model was turned on, it would NOT accelerate all the way up to top speed automatically! The added resistance was limiting the trigger current so the wheel did not have enough mechanical energy to transition from "double triggering" down to "single triggering" mode.

To compensate for this, a momentary contact switch was installed that could temporarily "short circuit" the added 36 Ohm resistor. This gave the added trigger power needed to make the transition once the unit got up to its relative "top speed" in double triggering mode.

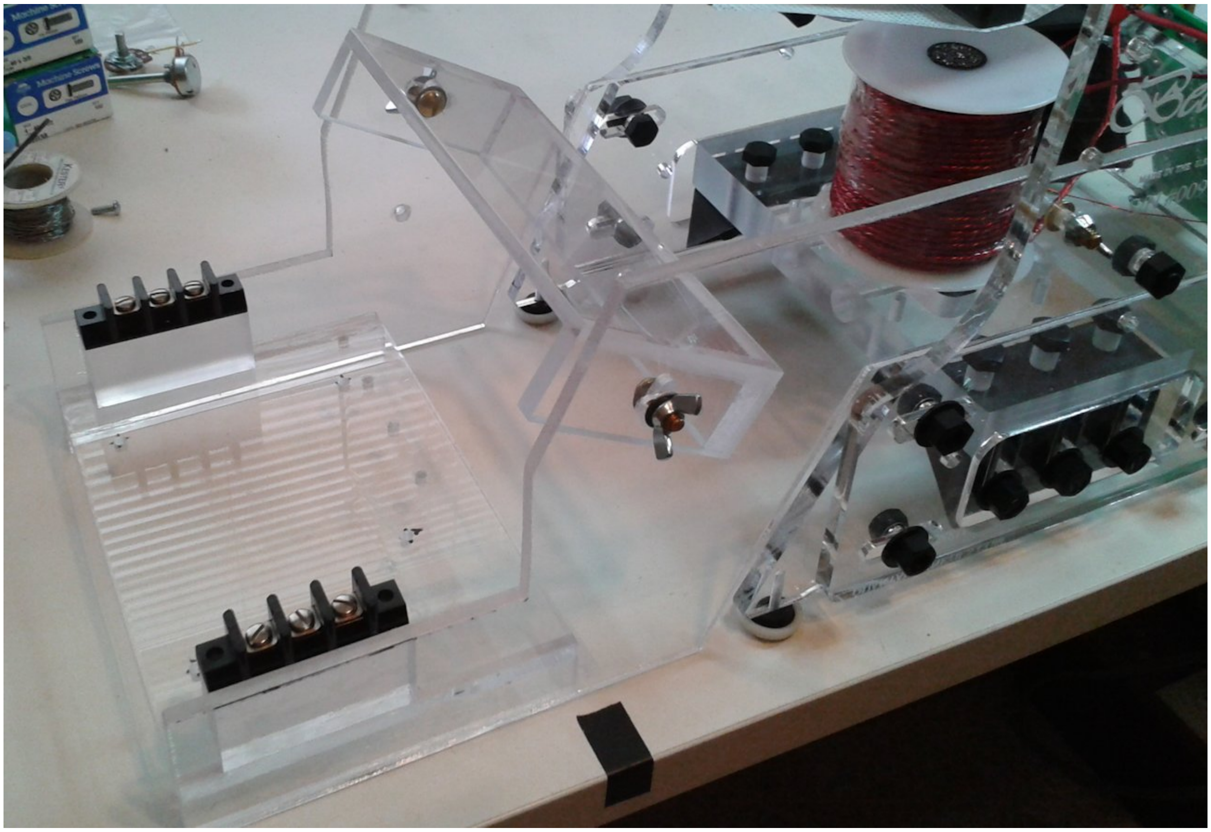
With the Trigger Shift Switch installed, all of the electrical and mechanical modifications were finished.

Results of these Modifications:

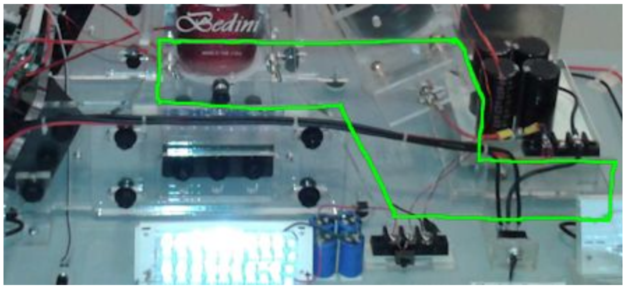
- Wheel runs in clean, circular motion with no side-to-side wobble
- Wheel attains a speed of 365 RPM, which is 80 RPM higher than the speed before the large wire and trigger refinements were installed
- Current draw dropped from 1.8 amps to 1.4 amps at higher speed
- Attains smooth running at highest speed with lowest input current!

Additions to the Frame

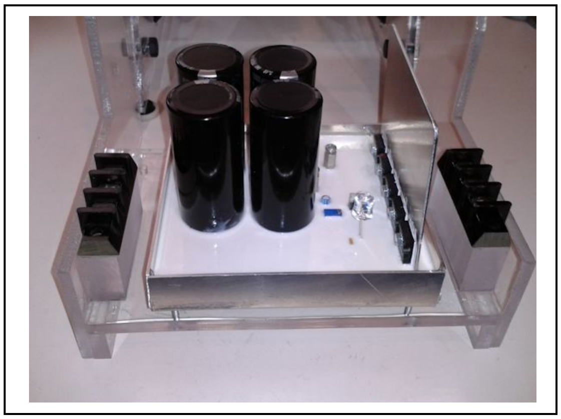
The next operation was to extend the frame to accommodate the mounting of the capacitor discharge circuit and the additional coil that would become the "low drag" generator. Since this unit was being prepared as a public demonstration, both of these features were incorporated as a single frame extension on the back side of the machine using clear acrylic.



The frame extension pieces bolt to the vertical supports of the original SG frame using one large black nylon nut and bolt which is also reinforced by the addition of two brass bolts and wing-nuts. The shape of the clear acrylic extension pieces is shown here, outlined by the **GREEN line**.

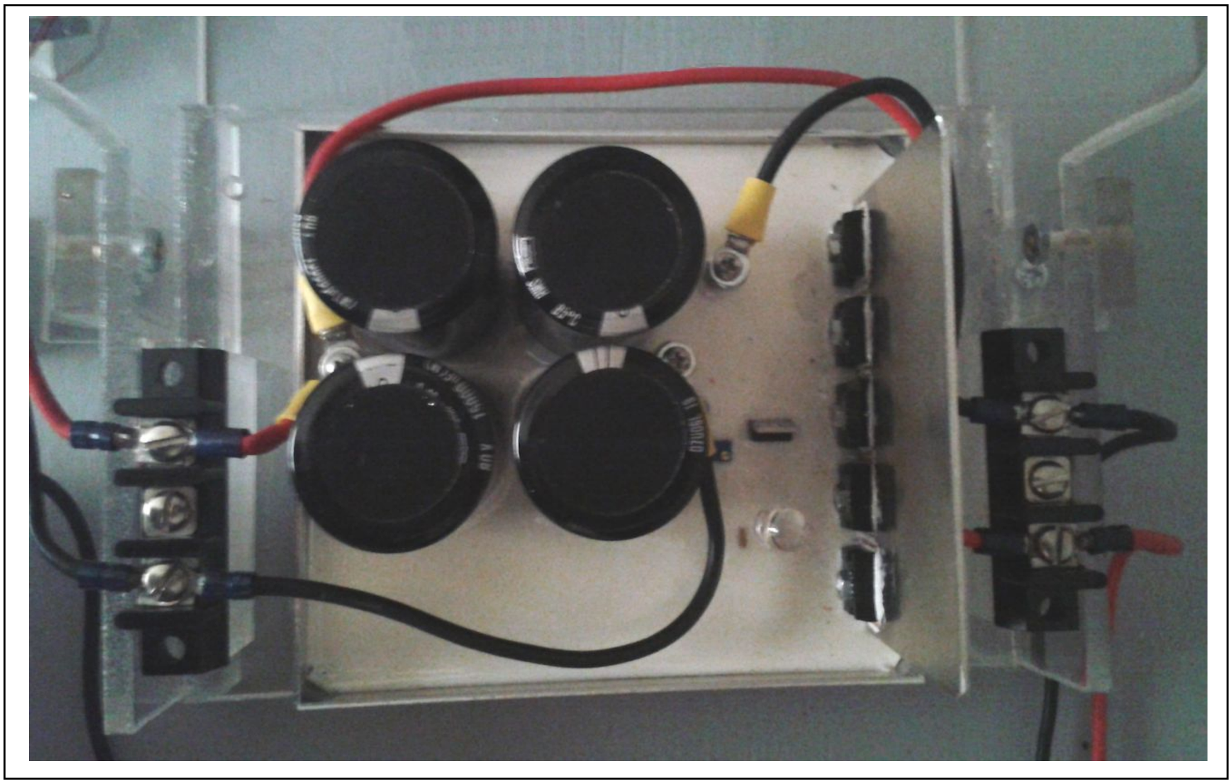


Mounting the Capacitor Module



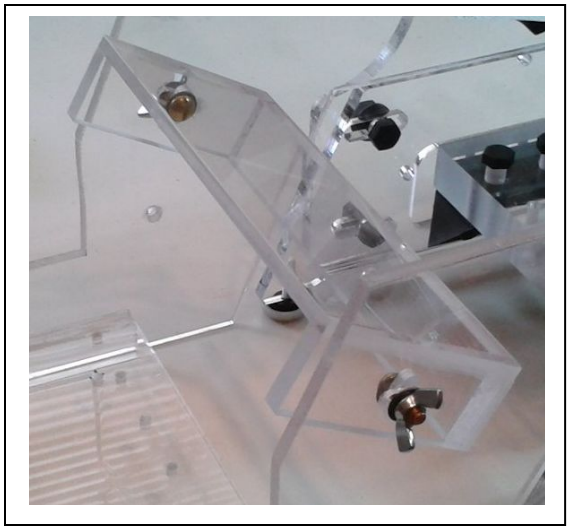
The lower platform was designed specifically for mounting the Comparator Circuit Module that John's company sells. The module has 4 small bolts coming out of the bottom of the potted base. Four holes were drilled in the acrylic plate and the capacitor system was bolted in place.

Two terminal blocks were mounted, one on either side of the capacitor module, to lead to external wiring of the system.



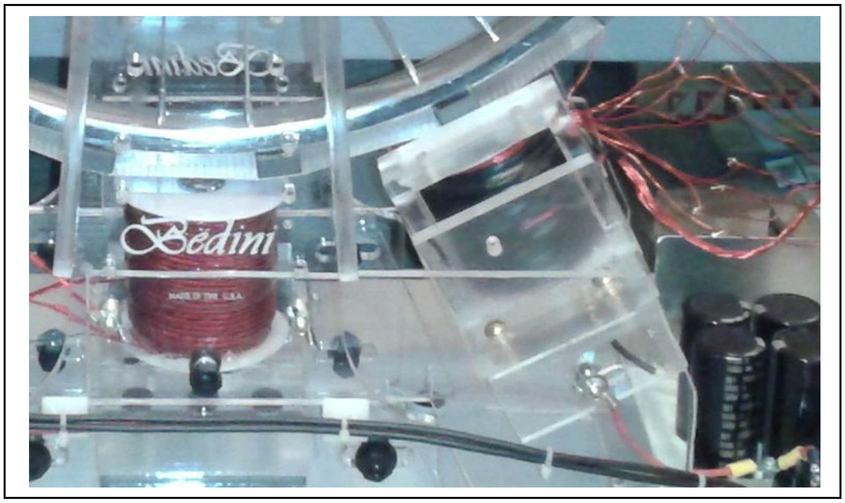
Here is an overhead photograph of the Capacitor Module wired in place. The wires coming in from the left provide the pathway to charge the capacitors with the coil discharges from the SG machine. The wires going out on the right provide the pathway to discharge the capacitors to the secondary battery (B2). The module senses the voltage in the capacitors, discharging them when that voltage rises to about 24 volts and then shuts off the discharge when the voltage drops to about 18 volts.

Mounting the Extra Generator Coil



The extra coil used for the generator needed to be adjustable, so the coil could be moved closer or farther away from the wheel. The platform shown here will hold the generator coil and allow it to be adjusted both for height and angle of approach to the wheel.

On top of this basic platform, a complex frame holding system was created. Since the magnets on the wheel were going to be exerting a strong attraction force toward the core in the generator coil, the coil had to be held absolutely rigidly to avoid vibrations in the frame and the possibility of an accident if the coil moved uncontrollably toward the rotating wheel.



A frame was built around the coil to clamp it in place, holding it down from the top. These acrylic pieces were then bolted down to the platform using two brass bolts and nuts on each side of the frame. Brass was used so the structure remained completely non-magnetic. The complete generator design will be shown in Chapter 4.

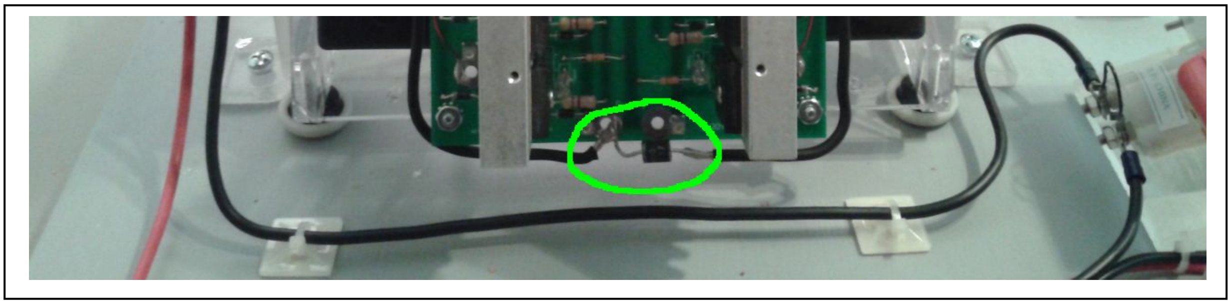
Adding the "Generator Mode" Circuitry

At the **2013 Bedini - Lindemann Science and Technology Conference**, John introduced the attendees to the new "Generator Mode" of operating the SG machine. The method seemed to draw a little bit more energy from the run battery, but cause the second battery to charge much more rapidly.

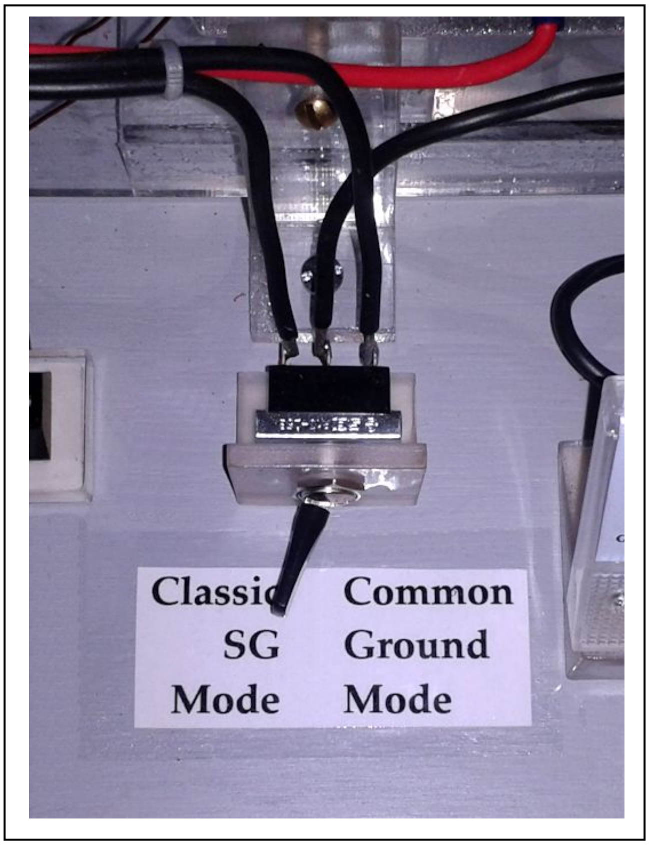
A number of demonstrations had been given of this process, but none of them was a "fully metered test" that quantified the level of benefit. So, the **Bedini SG: The Complete Advanced Handbook** would not be complete unless this recent innovation was thoroughly explored and reported.

The Classic SG Circuit routes the discharges from the main coil directly to the Output circuit to charge either the capacitor or the secondary battery. The so called Generator Mode Circuit re-routes the discharges of the main coil back through the Run Battery and then to the Output circuit. The benefits of this will be discussed in the next chapter of this book.

This new circuit places both the Run Battery and the Secondary Battery into a "common ground" connection where they had been in a "series connection" before. In order to isolate and balance the new arrangement, John introduced another Diode into the circuit on the ground line extension leading to the Output circuitry, shown here, circled in **GREEN**.



Since this was a display model designed for public demonstrations, both the SG Classic Mode connections and the Generator Mode connections were built into the machine. A switch was added to the circuitry so that the machine could be run in either mode, simply by flipping the switch.



John has always referred to this circuitry as the "Generator Mode" of operation. For the purposes of the Demonstration Model, and because there was an actual "Generator Coil" on the machine, it was decided to refer to the Generator Mode circuit as the "Common Ground Mode", as can be seen in the label in the photo to the right.

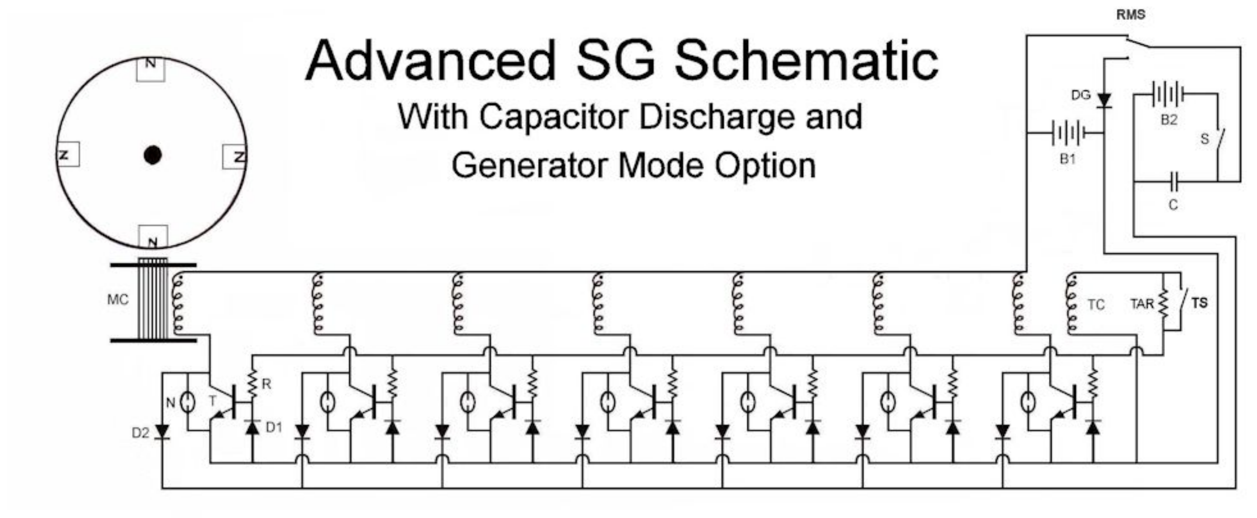
The **BLACK** wire that comes from the center connection on the switch goes off to the right with the **RED** wire to charge the capacitors. The other two **BLACK** wires that are attached to the outer connections of the switch and feed off to the left of the photo, connect to the either the Run Battery positive terminal (**+**) to create the Classic SG Mode circuit, or the Run Battery negative terminal (**-**) through the new diode to create the Common Ground or Generator Mode circuit.

So, the Generator Mode is a very simple modification of the circuitry consisting of one new wire and one new diode. The **Run Mode Switch** simply allows an easy way to alternate between the connections for demonstration purposes.

Full Schematic of the Advanced SG Machine

This completes the discussion of the features of the Conference Demo unit.

So, here is a complete schematic of the circuit of this fully "fine tuned" machine with all of the **Intermediate** and **Advanced** modifications included.



Parts Designations:

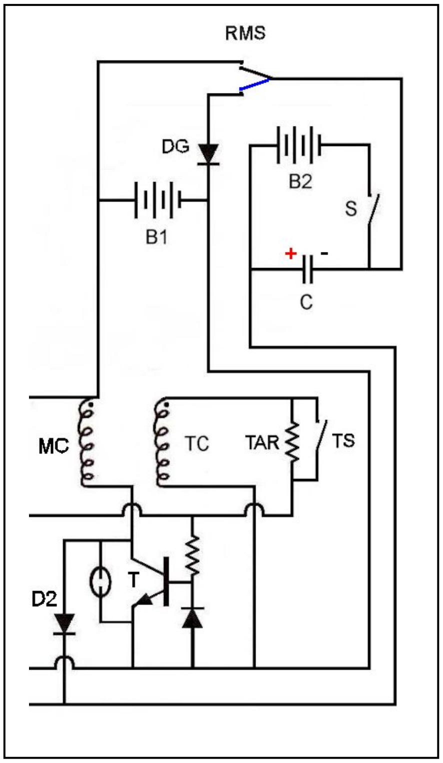
- T = Matched set of seven MJL21194-G NPN Transistors
- D = All Diodes marked either D1 or D2 are the 1N4007
- R = Matched set of seven 470 Ohm, 1 Watt Carbon Resistors
- N = Seven Neon Indicator Lights, 606C2A
- C = 60,000uf @ 80 VDC Photo Flash Capacitor
- TAR = Trigger Adjustment Resistor (Demo Model, 36 Ohm, 10 Watt)
- TS = Trigger Shift Switch (Momentary Contact type)
- DG = Diode for the Generator Mode Circuit, 6A100 (6amp, 1000volt)
- S = Capacitor Discharge Switch (Comparator Circuit or equivalent)
- RMS = Run Mode Switch, (Single Throw, Double Pole type)
- MC = Main Coil, Seven strands of #20 Gauge Magnet Wire, 130ft long
- TC = Trigger Coil, One strand of #23 Gauge Magnet Wire, 130ft long
- B1 (Run Battery) = 12v @ 35ah, flooded cell, Lead Acid Battery
- B2 (Charge Battery) = 12v @ 35ah, flooded cell, Lead Acid Battery

Chapter Two

Benefits of Running in "Generator Mode"

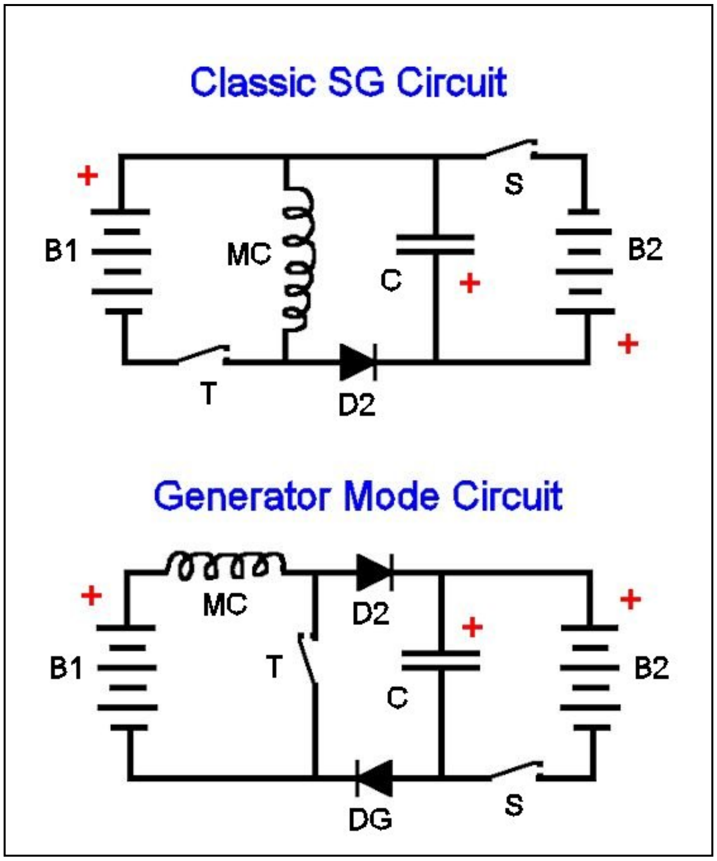
It's been about a year and a half since John started demonstrating what has become known as the "Generator Mode" at his shop. He said that it would draw a little bit more power from the front battery but that it charged the back battery much faster. He always said that the "trade-off" was well worth it, but at the time, no fully metered tests were offered as supporting evidence.

So, one of the primary goals of the Conference Demonstration machine, after it was fully "fine tuned," was to quantify what the Generator Mode was doing, and why.



The first thing to understand is the difference between the Classic SG circuit and the Generator Mode circuit. The image here is a clipping from the right hand side of the full circuit schematic on the previous page. It shows a single main coil winding and its associated transistor section, along with the rest of the circuit.

The Generator Mode modifies the Main Coil discharge pathway after the transistor turns off, and routes it back through B1 (the Run Battery) on its way to be collected in the Capacitor. You can see that the top of MC is connected to the positive terminal of B1 and completes the discharge path to the negative terminal of the capacitor C through RMS. When RMS is in the upper position, (Classic SG Mode) the discharge path by-passes B1 and goes directly to the negative terminal of C. When RMS is in the lower position (**Blue**), (Generator Mode) the discharge path goes back through B1 and through Diode DG on its way to the negative terminal of C. In both cases, the path to the positive terminal of C is routed through Diode D2.



Here is a comparison of the two circuits in simplified form. For clarity, the same circuit component parts designations used in the two previous drawings are used again here.

In the **Classic SG Circuit**, energy moves through the system in 3 distinct steps.
Step One: Energy from B1 is transferred to MC when switch T conducts.
Step Two: When switch T breaks the circuit, the energy stored in MC discharges through diode D2 and is collected in capacitor C.
Step Three: When the energy collected in capacitor C is sufficient, switch S temporarily conducts and discharges the energy into battery B2.

In the **Generator Mode Circuit**, energy moves through the system similarly, except in Step Two.

Step One: Energy from B1 is transferred to MC when switch T conducts.
Step Two: When switch T breaks the circuit, the energy stored in MC discharges back through battery B1 as well as through diodes D2 and DG, and then is collected in capacitor C.
Step Three: When the energy collected in capacitor C is sufficient, switch S temporarily conducts and discharges the energy into battery B2.

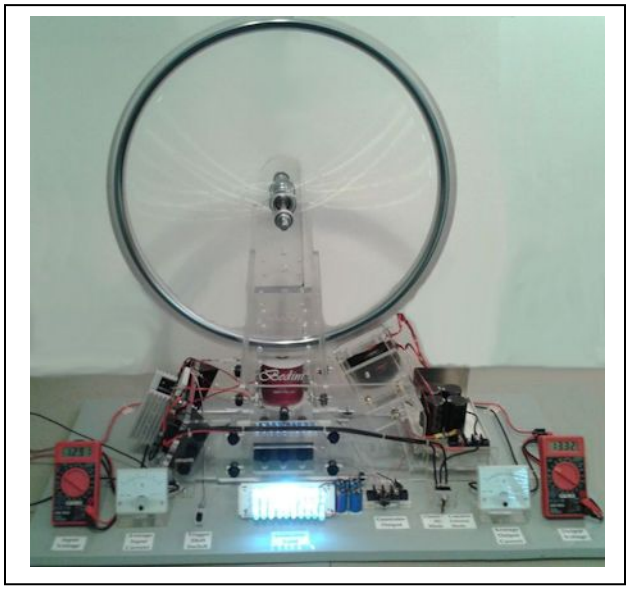
Hopefully, it is clear by now that the difference between the two circuits is that the Generator Mode circuit grabs energy from battery B1 TWICE each cycle, whereas the Classic SG circuit only grabs energy from battery B1 ONCE each cycle. This fundamentally alters the operation of the circuit and effectively changes the position of both the Main Coil MC and the Transistor T in relationship to the rest of the major components.

There are a number of ways to characterize this, but here is a simple analogy. The Classic SG circuit acts like a simple DC-to-DC buck converter, whereas the Generator Mode circuit acts more like a DC-to-DC boost converter.

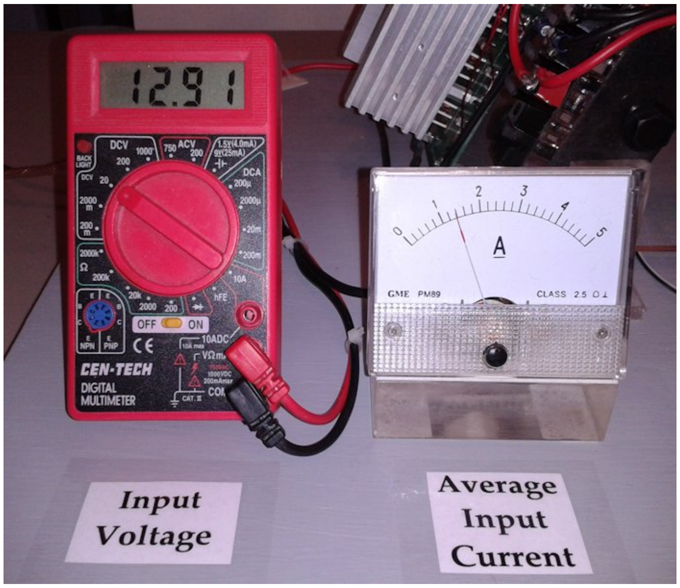
So, that is enough at this point on the circuit and the theory. Now, what does a fully metered working model look like on the bench?

Classic SG Baseline Input Measurements

In order to understand the benefits of running in Generator Mode, we have to understand what we are comparing it to. As explained in the previous chapter, the Conference Demo unit was a clean running machine. Its top speed with a fully charged Run Battery was a little over 365 RPM, but this speed was routinely measured on a photo-tachometer.

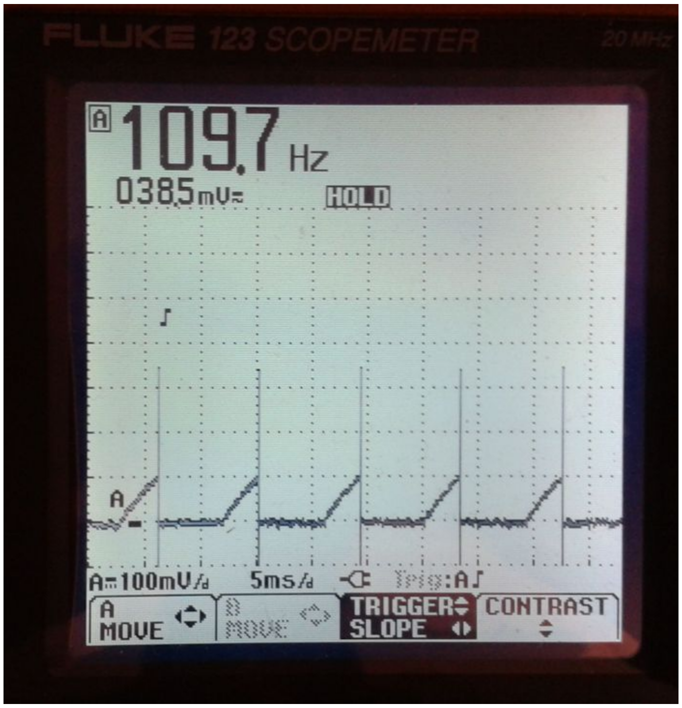


Typically, the SG circuitry is designed to draw approximately 0.25 amps per transistor, so a seven transistor circuit is expected to draw 1.75 amps from the Input Battery. The Conference Demo unit, with its balanced wheel, new bearings and fine tuned trigger circuit, was drawing 20% less than that. The in-line mounted analog Ammeter typically indicated just a shade under 1.4 amps at top speed.



This meter was labeled the "Average Input Current" for obvious reasons. The SG is a machine that runs on a series of DC pulses and an analog meter of this kind can only provide an average of the value of those pulses.

Although these meters do not provide a digitally precise measurement of the current used by the machine, they do provide a reasonably accurate indication of the average value.



To get a better understanding of the current input of the machine, a Fluke digital oscilloscope was used. The analog Ammeter is a 50mV movement measuring the voltage across a 0.010 Ohm resistive shunt. When this voltage was simultaneously observed on the Fluke meter, this image was produced. It shows pulses that peak at a height of about one division repeating 109.7 times per second.

Let's look at the speed of the wheel first. We know that there are 18 magnets on the wheel, so the following calculation can be made:

109.7hz ÷ 18 = 6.094 RPS × 60 = 365.66 RPM

This is within one RPM of the speed measured by the tachometer, so this is encouraging. Next, let's look at the calculations for current.

The average value of the current can be calculated from the Fluke Scope image by measuring the "area under the curve" defined by the graph line on the scope. The waveform has a peak amplitude of about one division. The scope setting is that one division equals 100mV. From this we can determine the peak current value using the shunt resistance of 0.010 Ohms and Ohm's Law (E/R = I). That calculation is here:

0.100 volts ÷ 0.010Ω = 10.00 amps

Next, the width of the base of the wave-form is measured as about 36% of the total wave length and the rising line roughly bisects this area. This defines the "area under the curve" as one half of 36% or 18% of the 10 amp peak value. This gives us the following calculation.

0.100 volts ÷ 0.010Ω = 10.00 amps × 18% = 1.8 amps

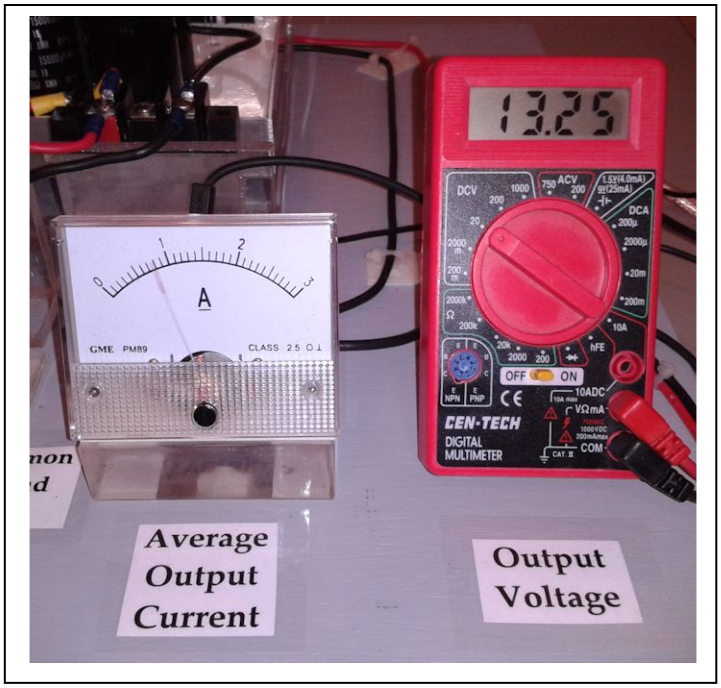
This calculation deviates from the indication on the analog Ammeter by a significant margin, and may suggest one of two things:

1. that the analog meter is way out of calibration, or
2. that our estimate of the peak value shown on the scope is too high.

Most engineers will immediately choose #1 as the problem and confidently put their faith in the Fluke Scope image. With my years of experience with these machines, my tendency is believe the analog meter, based partially on the voltage reading of the battery indicating a slow discharge rate.

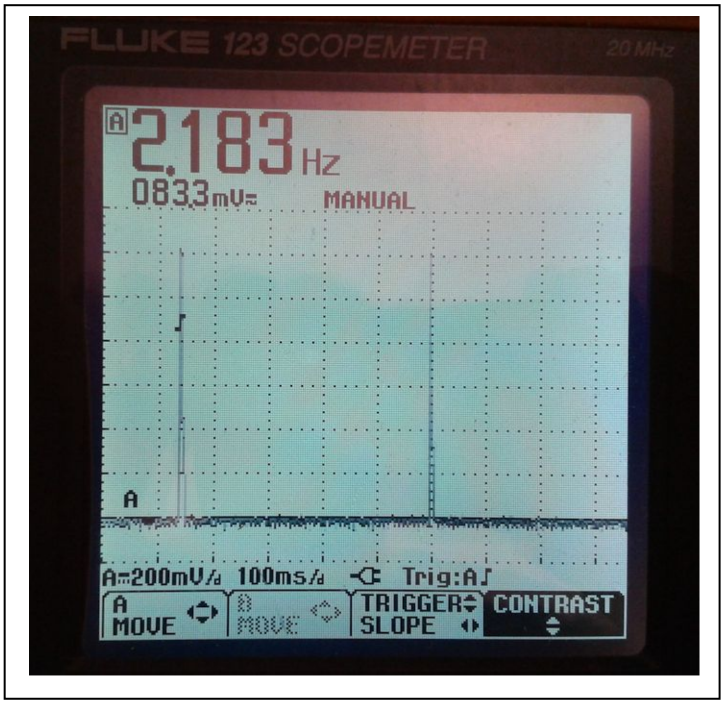
At this point, if you are willing to look at these measurements as "important indicators" rather than "absolute values," you may be better prepared to accept the importance of their relationship to other measurements taken on the machine in the same manner.

Classic SG Baseline Output Measurements



OK, let's move on and look at the indications on the Output Meters. Whereas the Input Analog Ammeter was a 0-5 amp scale, the Output Analog Ammeter is a 0-3 amp scale. This meter is also a 50mV movement, but its Resistive Shunt is 0.0166 Ohms.

This meter is measuring the currents associated with the Capacitor Discharges into the charge battery (B2). While running, the indicator needle is bouncing between "0" and "1.2" on the scale. The digital Output Voltage is taken directly across battery B2.



The operational indication on the Output Analog Ammeter suggests that the current coming out of the machine may be averaging about 0.6 amps, which is about 45% of the average current being applied to the Input.

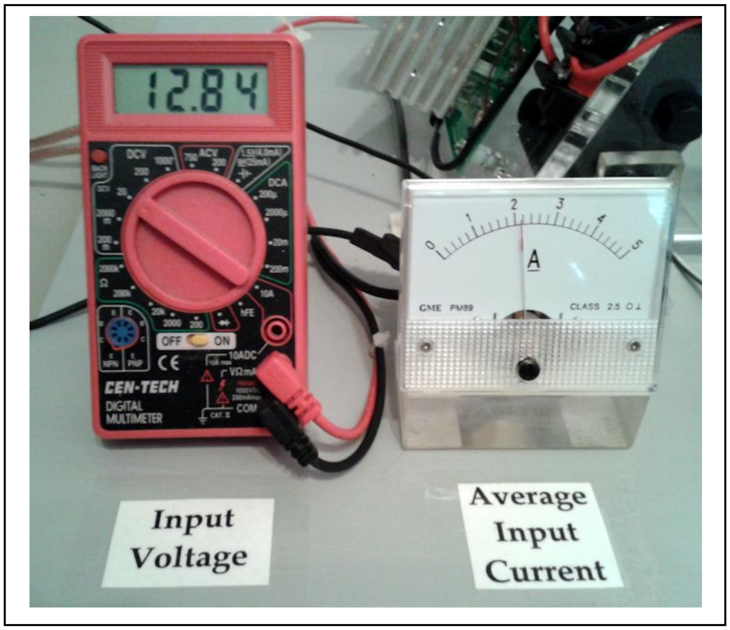
When the Fluke Scope Meter is applied across the resistive shunt of the Output Ammeter it produces this image.

The first thing we can see is that the capacitor circuit is discharging into the charge battery B2 at a rate of 2.183 times per second. While this discharge rises to a height on the scope of 6 divisions, its total width is quite narrow, and its duration is expended in approximately 16 milliseconds (0.016 seconds). With a setting of 200mV per division, the peak value of the current impulse as it begins can be calculated as:

$$\mathbf{200mV/d \times 6\ divisions \div 0.0166\Omega = 72.28\ amps}$$

So battery B2 is being charged by 72 amp pulses 2.18 times per second. The exact number of joules of energy this represents is not quantifiable from these measurements. The average output current this represents can be estimated by the "area under the curve" method from the scope image. The area under this waveform is about 1% of the total area, so the average current output by this method is around 0.7 amps, which is similar to the analog ammeter. Regardless of the absolute value of these impulses, the battery is responding to them quite well.

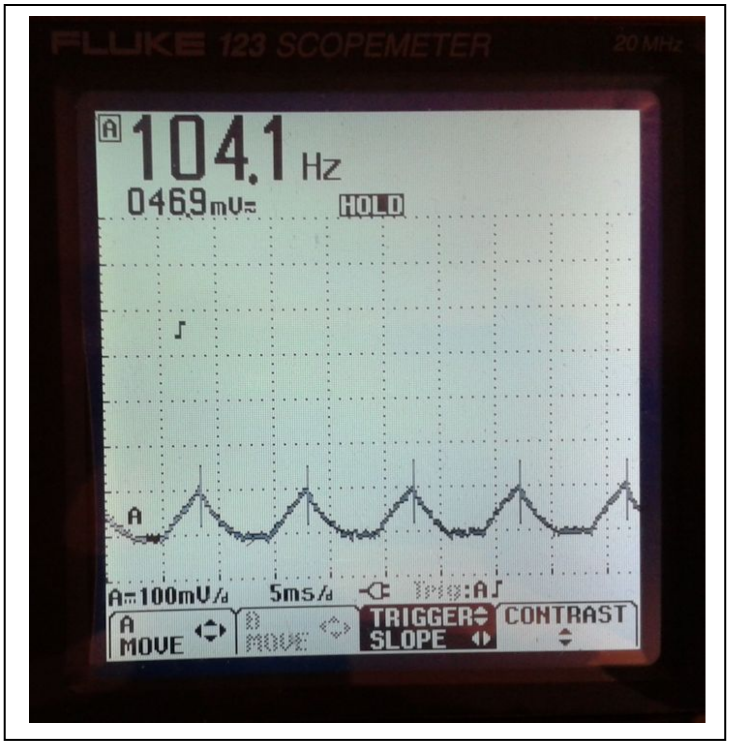
SG Generator Mode Input Measurements



When the unit is placed in Generator Mode, a number of things change. The wheel slows down a little, the input current goes up, and the voltage of the Input Battery drops.

Here are the Input Meters for a typical run of the Generator Mode. The analog Ammeter is reading about 2.15 amps and the speed is registering at about 335 RPM. So, according to the analog ammeter, the current input has risen from 1.4 amps in the Classic SG Mode to 2.15 amps in the Generator Mode. The ratio of increase can be calculated as follows:

2.15 amps ÷ 1.4 amps = 1.53. That represents **an increase of 53%.**



With the Fluke Scope Meter across the ammeter shunt, we can now finally see what the Generator Mode circuitry is doing to the input waveform.

The thin line at the tops of the triangles is where the transistors shut off. The rising wave before that is the standard input we saw on page 27, and the falling wave after the transistors shut off is the extra energy the Generator Mode Circuit takes from the run battery (B1) on the discharge of the Main Coil, MC.

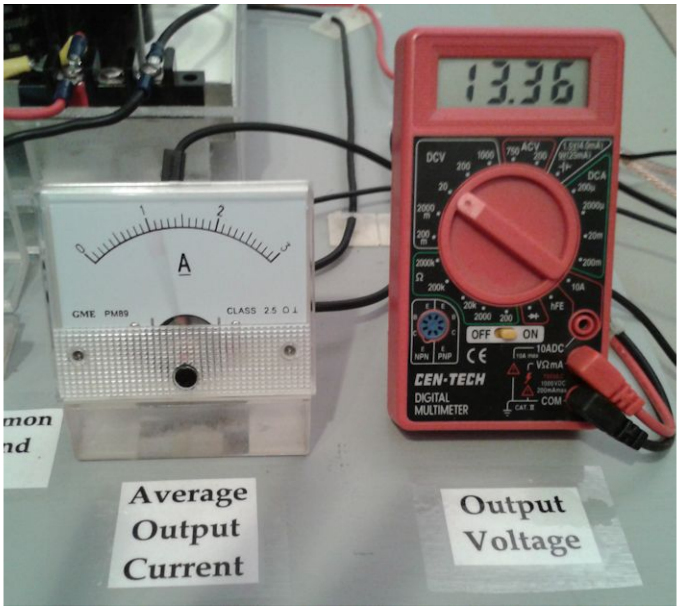
So, this is what the analog Ammeter is interpreting as an increase in the Average Input Current of 53%. Attempts to quantify this input current using the "area under the curve" method produce a similar figure. With the input calculated as 18% of the 10 amp peak value, the output adds another 10% on that, for a total Average Input Current of 2.8 amps.

The ratio of this increase can be calculated as follows:

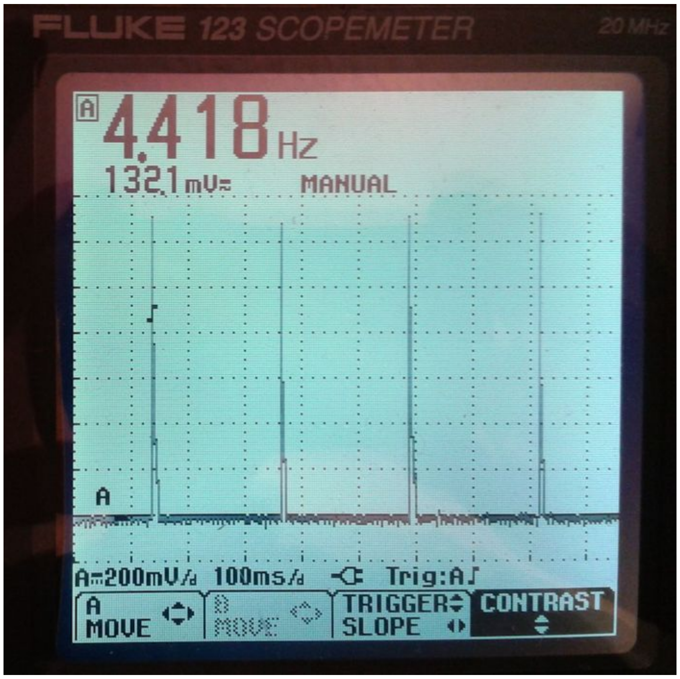
2.8 amps ÷ 1.8 amps = 1.55. This represents **an increase of 55%.**

So, despite the variations in the absolute values indicated, at least the measurement methods are remaining essentially proportional in their ability to indicate the increase in the Average Input Current relative to the two modes of operation.

SG Generator Mode Output Measurements



The indicator needle on the Output Analog Ammeter is now bouncing between "0.5" and "1.5" amps. The Volt Meter is clearly showing an increased charge rate as it now indicates 13.36 volts whereas before it was showing 13.25 volts. But the big action is showing on the Fluke Scope Meter image.



The Fluke is showing that the capacitor is discharging 4.418 times per second and the peak current per impulse is now rising to 6.6 divisions. This equates to 78 amp impulses being delivered to the charge battery (B2) 4.418 times per second.

The charge rate has increased from 2.183 times per second in the Classic SG Mode to 4.418 times per second in the Generator Mode. The ratio of this increase can be calculated as follows:

4.418 Hz ÷ 2.183 Hz = 2.023 This represents **an increase of 102%.**

Since the capacitor discharge system is voltage controlled, and the discharge and re-set trip points have not been changed between the two tests, it is reasonable to believe that the number of Joules per pulse has also not changed, and therefore, the actual quantity of energy being delivered to the charge battery (B2) has more than doubled while the energy expended at the input has gone up by about half as much!

Charging Benefits

This data certainly supports John's statements concerning the benefit of the Generator Mode. For the purpose of this narration, it would take a lot more time to fully quantify these energy translations and eliminate all of the measurement ambiguities, but you are welcome to do that for yourself on your own model. The purpose here is simply to point you in the right direction.

Running the SG in Generator Mode seems to add a little electrical current to the otherwise low current spikes coming from the discharges of the Main Coil MC. Since the capacitor is charging and discharging twice as fast, the temporary electret effect also has less time to dissipate, so more of the spontaneous recovery of its electrical charge can be delivered to the secondary battery. That is, at least, one reasonable explanation.

In other materials, John discusses the "widening" of the waveform used to charge the capacitor as the primary explanation for the energy gain from using this method. You are encouraged to explore this process as deeply as you wish, and even come up with your own explanation should you so desire. The point is this; you now have been shown THREE distinct energy gain methods used by John to effectively off-set all of the electrical losses. These are:

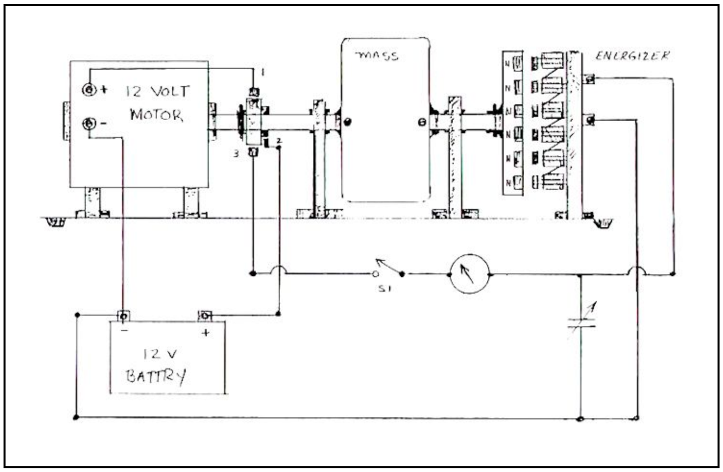
1. the rapid "finishing time" of the batteries when cycled repeatedly
2. the "temporary electret effect" that appears in the capacitor
3. the Generator Mode of operation

Chapter Three

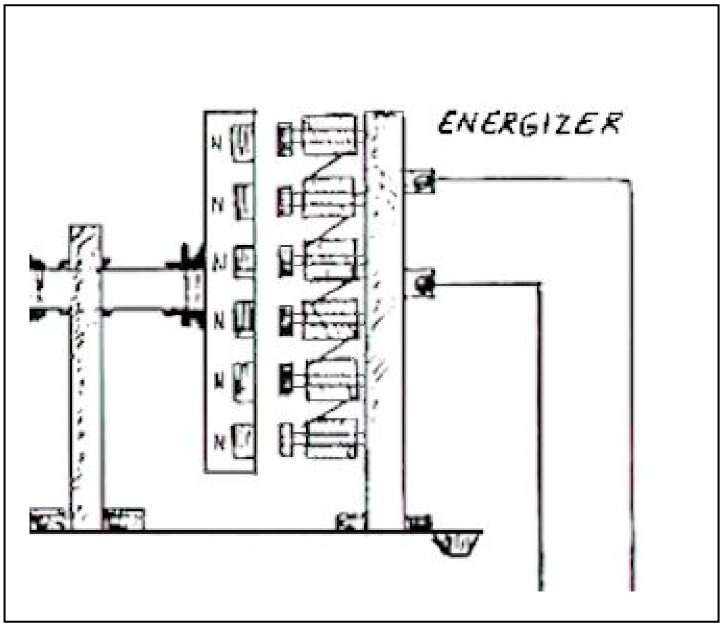
SG Energizer "Self-Rotation" Functions

Without fail, every time someone has referred to the SG machine as "an electric motor," John has tried to correct them. He has always said "it's not a motor, it's an **Energizer**."

Of course, John knew exactly what he was talking about, but most of the rest of us have resisted understanding this for a very long time. So, once and for all, here is what John has been trying to tell us!



The original machine described in John's 1984 book titled ***Bedini's Free Energy Generator*** was an electric motor turning a flywheel and an electric generator that had a number of unique features, which he called the ***ENERGIZER***. Here is an enlargement of the image of that drawing. It is clearly made up of a wheel with all North Facing permanent magnets on it, spinning in front of a group of stationary coils with iron cores in them. It is clearly designated as the "Energizer."



The function of the Energizer is critical to the operation of the energy gain mechanism. On page 13 of John's original book, he states:

"There are **many different ways** to explain this theory."

On page 21, he states that:

"The battery is really **charging itself**."

On page 22, John says:

"The waves we want to generate
are like those that come from old DC generators,
with the exception of armature drag, bearing drag and no excited fields."

And finally he says that:

"I have run some tests in my lab and discovered that certain types of energizers, generators and alternators **do what we need**."

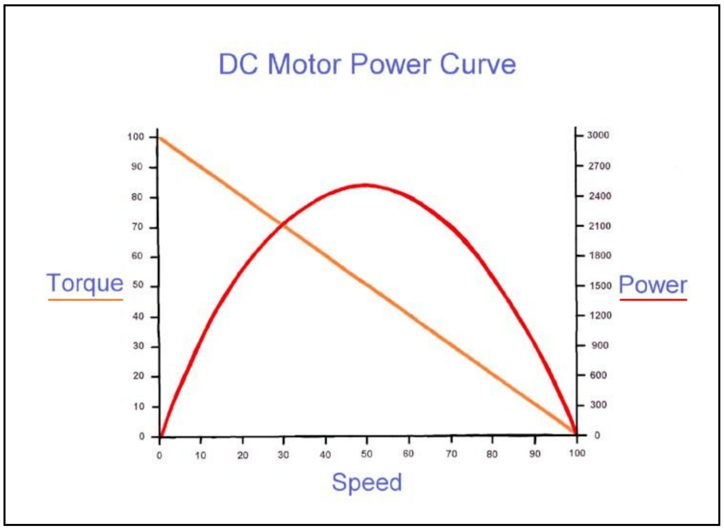
To reiterate John's discovery, here is a quote from Chapter 1 of **Bedini SG, The Complete Beginner's Handbook**:

> "The energizer was a special generator that didn't slow down as much as a normal generator when electricity was coming out of it. The rotating switch allowed the battery to be charged part of the time, and then run the motor the rest of the time. As the years went by, John realized that if he could get the energizer to turn itself, he could eliminate the electric motor and really simplify the system."
>
> "The original energizer consisted of a wheel with a series of permanent magnets on it that would rotate in front of a number of coils of wire. As the magnets moved passed the coils, pulses of electricity would come out of the coils to charge the battery. But John also knew that the wheel could be made to turn if a pulse of electricity was put back into one of

> the coils at the right time. It was just a matter of developing the right switching method."
>
> "The new system consisted of an energizer, a battery, and a special timing circuit. That eliminated half of the components, including the electric motor, the rotary switch, and the flywheel."

By a simple substitution of words, the machine can be seen to be the original "low drag generator" with an added circuit to cause it to self-rotate. Over the years, John has run hundreds of experiments on this "technology platform" and developed a "self-rotating" method that recovers 100% of the electricity needed to keep it turning. So, this brings us to the SG as we know it. The only things missing are all of the other non-energized coils that make up the rest of the low drag generator!

The Development of Rotating Mechanical Force in an Electric Motor



In order to understand what John means when he says the SG is not an electric motor, we have to understand what an electric motor is and how it develops mechanical energy.

This graph illustrates the power curve of a typical DC motor with a commutated armature. It shows the relationship between the Speed, the Torque produced, and the consequent Power, which is a cross-product of the Speed and Torque. In this diagram, the Torque is shown by the **Orange Line** and the Power is shown by the **Red Line**. In a motor like this, the Torque is a direct consequence of how much electric current is moving through the armature windings in front of the stator magnets.

So, when the motor is just starting, the speed is the lowest, but the current draw and the torque is the highest. As the motor runs faster and faster, the current draw and the torque produced start dropping off due to the production of the back EMF in the windings. As the Torque approaches its lowest point, there is no longer enough mechanical energy produced to make the motor turn faster, so it reaches its Top Speed. These relationships can be seen by following the **Orange Line** down as the speed increases.

In both of these speed extremes, the power produced by the motor is relatively low, since one of these "multipliers" has a very low value. Only in the mid-range of both the torque and the speed, does the consequent power "cross-product" of these values reach its peak.

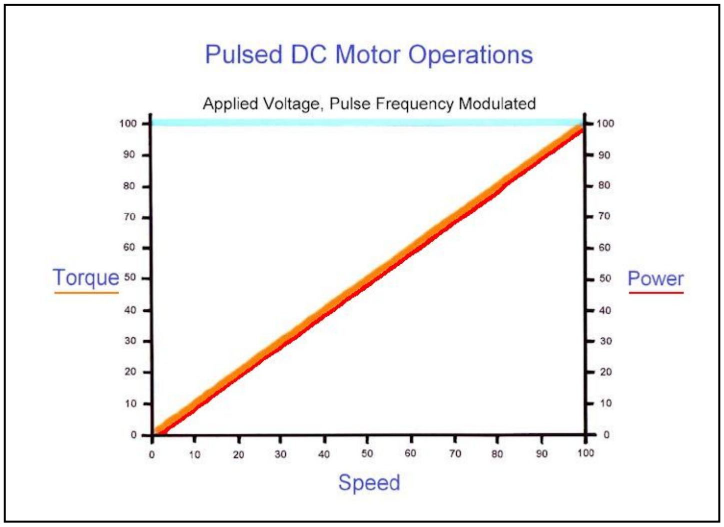
This can be seen in the values for Power listed on the far right of the graph. Whereas 10 × 90 = 900 near the start-up or the top speed, the mechanical power peaks in the mid-range where 50 × 50 = 2500. This is why a motor like this must be slowed to 50% of its unloaded speed in order to accurately measure its power on a dynamometer test.

While being a little counter-intuitive, this "power curve" produces a very handy performance feature. When mechanical energy is withdrawn from a machine, the removal of this energy usually *slows the machine down*. This is true of almost all mechanical systems.

In the case of the DC Motor, its performance is such that if a mechanical load is applied to the motor at its top speed, it will slow down. But, as the speed drops, the power RISES to match the mechanical load, to keep the drop in speed to a minimum. The best thing about this, is that this speed-power regulation of the machine happens automatically, as long as the applied voltage remains the same. This makes this type of electric motor extremely useful for the production of mechanical energy.

So, the ability of an electric motor to produce MORE mechanical power as it slows down is the specific feature that John is saying is NOT present in the Self-Rotating Energizer.

The Development of Rotating Mechanical Force in the SG Energizer



The SG Energizer produces a mechanical attraction each time the coil turns ON. This attracts one of the permanent magnets on the wheel until it is directly over the coil, at which point, the coil turns OFF and the magnet slips past.

Each time this process happens, it draws a specific quantity of electric current from the run battery and produces a specific quantity of mechanical energy on the wheel. As the speed increases, this process is repeated more times per second, and therefore the power increases in a direct relationship to the speed. In the graph above, this is shown as the **Orange Line** (Torque) and the **Red Line** (Power) rising together.

[This is, at least, what the torque-power curve of the SG looks like when it is operating in "single triggering mode."]

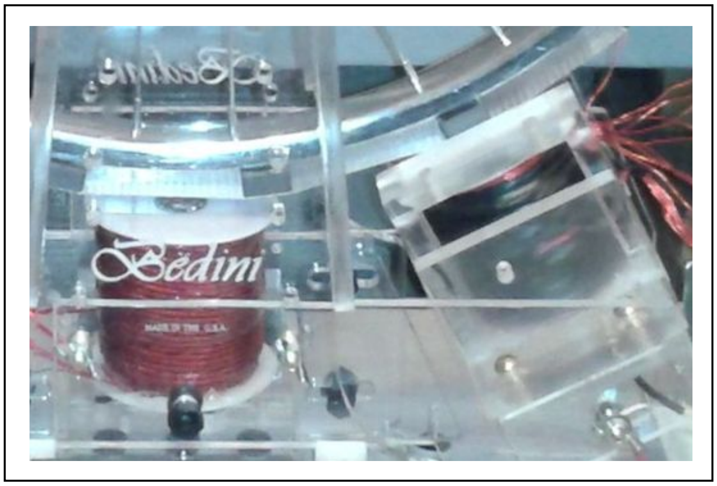
While this torque-power profile is interesting and has some advantages, it is NOT the same as a standard electric motor power curve. It also means that the SG Energizer is NOT capable of producing more mechanical power as it slows down and is therefore NOT suitable to provide mechanical energy to external loads like an ordinary electric motor does.

So, this is what John has been trying to get us to understand; that the SG is a "self-rotating Energizer" designed to produce excess electrical energy (when all of the extra coils are present) while producing ***enough*** mechanical energy to keep itself spinning.

Chapter Four

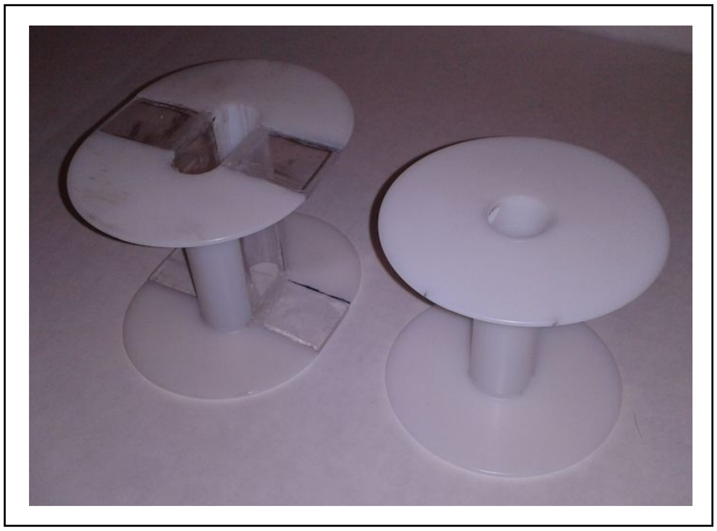
SG Energizer Extra Coil Generator

In addition to the SG Advanced circuitry and optimized operations, the Conference Demonstration model had an "extra coil" generator as well.



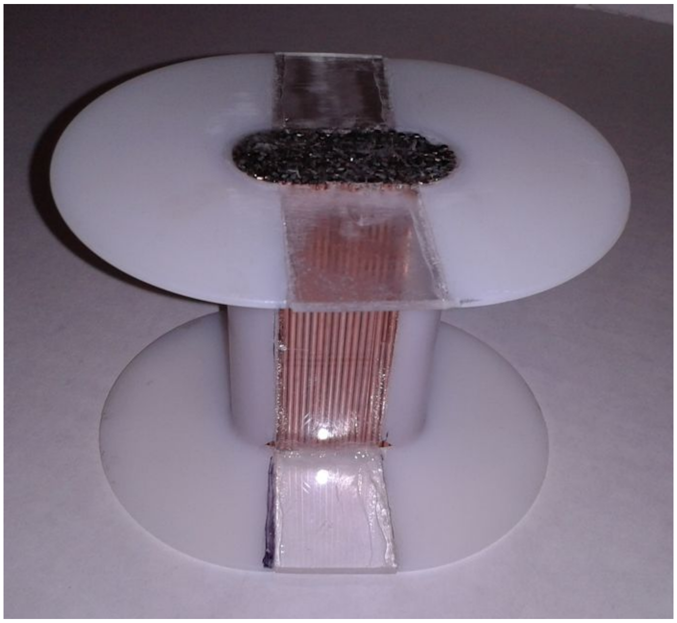
The power coil (behind the Bedini Logo) and the generator coil can be seen next to each other in this picture. Since the permanent magnets on the wheel were only a single Ceramic #8 magnet each, and since these magnets were the only magnetic field input for the operation of the generator coil, this coil was designed to operate on this relatively low magnetic field.

The Generator Coil



The purpose of the Demonstration Model was to "demonstrate the principle" of the Low Drag Generator using a single coil. To maximize the low magnetic field levels, it was decided to widen the iron core of this coil so it could capture more of the magnetic flux from the permanent magnets. Therefore, a plastic spool like the one used for the power coil was cut in half and the center section was extended by 1 inch.

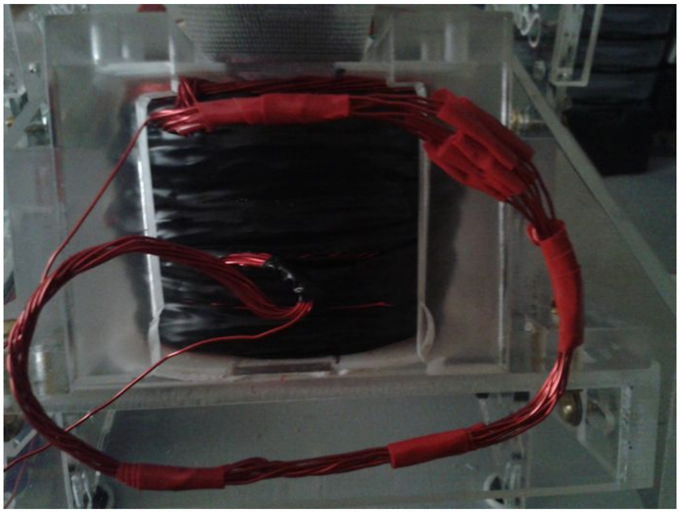
This produced a coil core area that more closely approximated the rectangular shape of the magnets. The open area was then filled with the same R45 iron welding rod material used in the power coil.



This simple modification produced a coil core with 3 times more iron in it and allowed much more of the magnetic flux from each magnet to be captured.

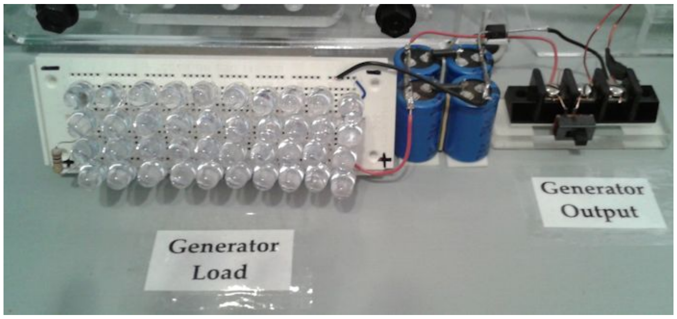
When this coil form was wrapped with wire, it took about 60% more wire to make each turn, but the core captured 300% more magnetic flux than the simple round core would have. Over all, the trade-off was well worth it.

Once the coil form and core material were positioned, the iron rods were glued in place using cyanoacrylate (super glue) adhesive, similar to the process shown on page 61 of the **SG Beginner's Handbook**.



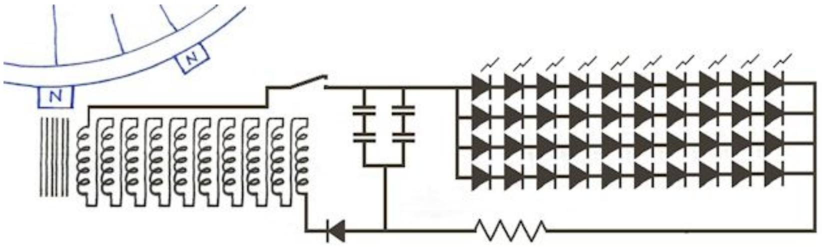
The coil form was then wound with 10 strands of #16 wire that had been twisted into a bundled cable like the power coils use. The process to make a coil like this is shown on page 57 of the **SG Beginner's Handbook**. These individual wires were then connected in series to produce a single #16 wire about 1,000 feet long.

The Circuit



The output of this coil came directly to the circuit shown here. It consisted of an ON/OFF switch, a diode, a capacitor, a resistor, and 40 LEDs.

The switch was a simple toggle type. The diode was a 6A100. The four capacitors together had a capacitance of 470uf. The resistor was rated for 100 Ohms at one watt. The 40 LEDs were wired as 4 parallel strings of 10 LEDs connected in series.



The complete circuit is shown here.

The Test Results

In actual operation, the extra generator coil lit up all 40 LEDs to a brightness too bright to look at directly. On the Conference film it was stated that turning the lights ON and OFF did not change the speed by even one RPM. The exact results of specific tests will be discussed in more detail in Chapter Six.

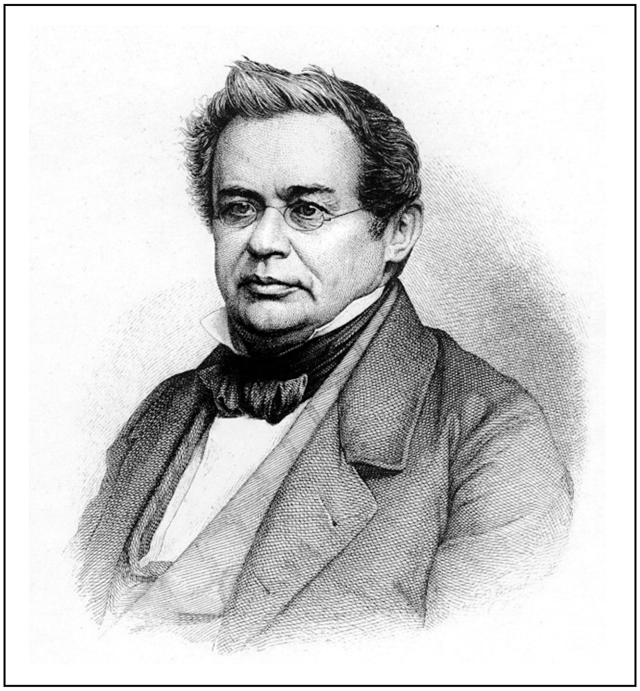
For all practical purposes, the generator coil produced extremely **LOW DRAG** on the SG Energizer while lighting 40 LEDs. Everyone at the Conference saw this done. Nobody understood what they were looking at.

What is this? Why can't people understand it? Why does this work?

Chapter Five

Understanding Lenz's Law

Heinrich F. E. Lenz was a Russian Physicist, born in the city of Dorpat in the Russian Empire in 1804. His parents were ethnically German speaking Prussian expatriates and so Lenz is quite often referred to as a German Physicist as well.



Lenz originally studied at the University of Dorpat, but later taught Mathematics and Physics at the University of St. Petersburg. While he made many contributions to the sciences of his day, he is best remembered for his early experiments in magnetics and the formulation of what has become known as Lenz's Law.

The use of the symbol "***L***" for inductance was also chosen in honor of Lenz.

Understanding Lenz's discovery

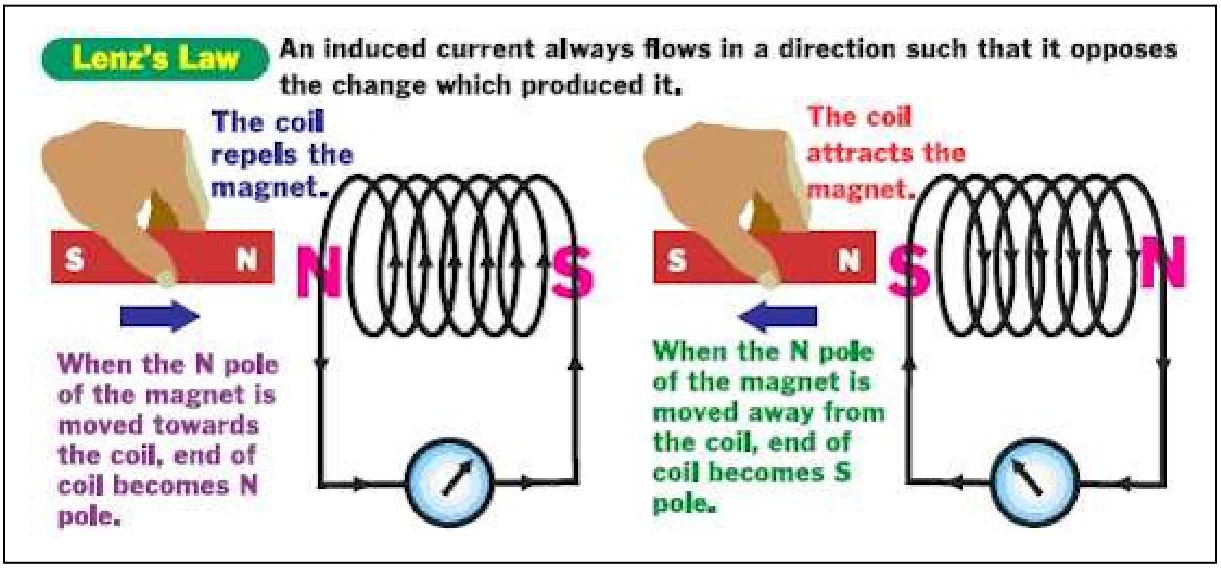
By 1831, Lenz was studying the new science concerning electric generators and electric motors. His first paper in this field addressed what he called the "Law of Reciprocity of Magneto-electric and Electro-magnetic Phenomena." This paper contained the first published statement of "Lenz's Law." His observation was that when mechanical energy was removed from an electric motor, it behaved like an electric generator in reverse, and that when electrical energy was removed from an electric generator, it behaved like an electric motor in reverse.

Today, these observations are expressed as follows:

> The current induced in a circuit due to a change or motion in a magnetic field is directed to oppose the change in flux or to exert a mechanical force opposing the motion.

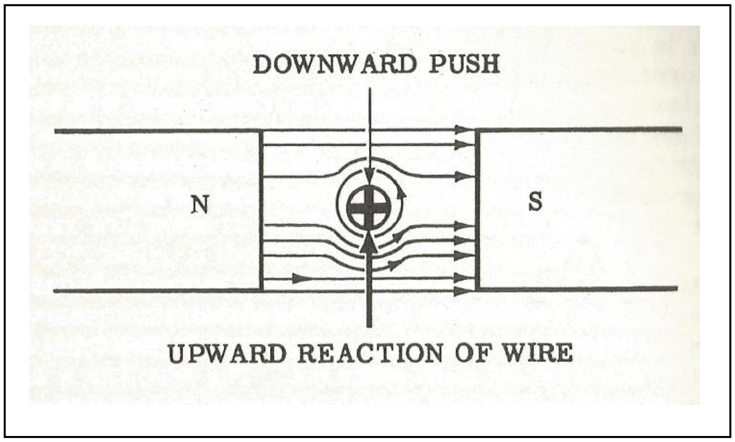
This reciprocal action between an induced current and the changes in the inducing magnetic field was present in every experimental arrangement that Lenz studied, and he came to believe that it represented an expression of the "Law of Conservation of Energy." It also supported the idea that "a change in the energy state of a system could not propagate itself."

Here is one of the simplest illustrations of Lenz's experimental results.


Lenz's Law
An induced current always flows in a direction such that it opposes the change which produced it.
The coil repels the magnet.
S
N
N
S
When the N pole of the magnet is moved towards the coil, end of coil becomes N pole.
The coil attracts the magnet.
S
N
S
N
When the N pole of the magnet is moved away from the coil, end of coil becomes S pole.

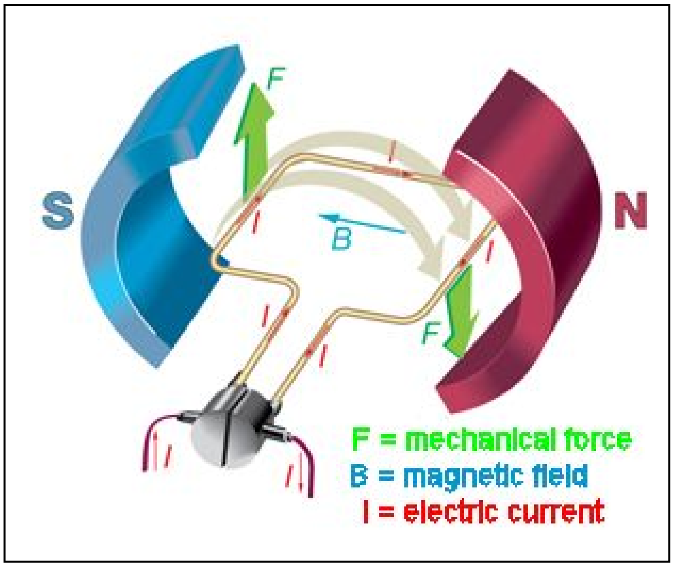
If the North Pole of the permanent magnet approaches the coil, current flows in the coil in a way that produces a second magnetic field that repels the magnet's approach. When the North Pole of the permanent magnet is then pulled away, the induced current in the coil reverses and produces a magnetic field that tries to attract it back in.

In its most basic presentation, Lenz's Law can be illustrated like this:

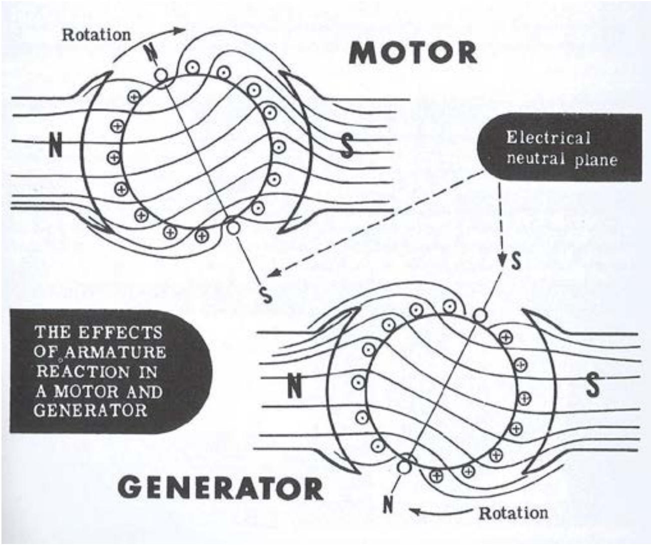


If a wire is situated in a magnetic field such that a North Pole is on the left and a South Pole is on the right, and a mechanical force moves the wire in a downward motion, a current in the wire will be produced that creates a magnetic field around the wire that tends to oppose the field above the wire and reinforce the field below the wire. These induced magnetic effects from the current in the wire create an upward mechanical reaction force on the wire in direct opposition to the downward motion that initiated it.

So, Lenz's Law describes a complex interaction between magnetic fields, electric currents, and mechanical forces which are all tied together because of a specific geometry of materials and motions.



This image describes how these forces behave in an ordinary DC motor. When the magnetic field is described as **B**, and the electric current is described as **I**, then a mechanical force appears on the wires, shown as **F**. What makes the motor spin is the appearance of this mechanical force. But when this force moves the wires through the magnetic field **B**, it induces a potential in the wires that will try to reverse the flow of current. If the mechanical force in the direction of **F** becomes the "input" to the device, the machine becomes a "generator" and produces electric current in the opposite direction shown.



Lenz was the first to describe these interactions. When the current leads, the force appears as the reaction, and we call the device a "motor." If the force leads, then the current appears as the reaction in the opposite direction, and we call that device a "generator." But really, it is the same machine with the ability to appear as either a motor that inherently generates against itself or a generator that inherently motors against itself, depending on which force leads the other. Modern theory calls this the "armature reaction" and shows it as an angular displacement of the "electrical neutral line" in the rotor.

It is extremely important to understand that you can't "DEFEAT" Lenz's Law. It is an accurate description of the behavior of the forces of Nature as they appear within this specific configuration of materials. What you CAN DO is study the minute details of how this process manifests itself and learn how to engineer around it! That is what John Bedini did in the 1980s.

Since most commercially available electric motors and generators use the same basic geometry as is illustrated above, these machines all behave in a manner that is consistent with the assumption that Lenz's Law is universal in its appearance and that it is an example of the "Law of Conservation of Energy" as Lenz believed. Luckily, this is not true.

The goal is to produce electricity from magnetic induction without the appearance of the associated mechanical reaction forces produced by the interaction of the induced currents and the primary magnetic fields. This is what allows you to make an electric generator that does not slow down when electricity is removed from it. The question is: what's the trick?

Modifying the Appearance of Lenz's Law

Let's review the specific conditions under which Lenz's Law appears.

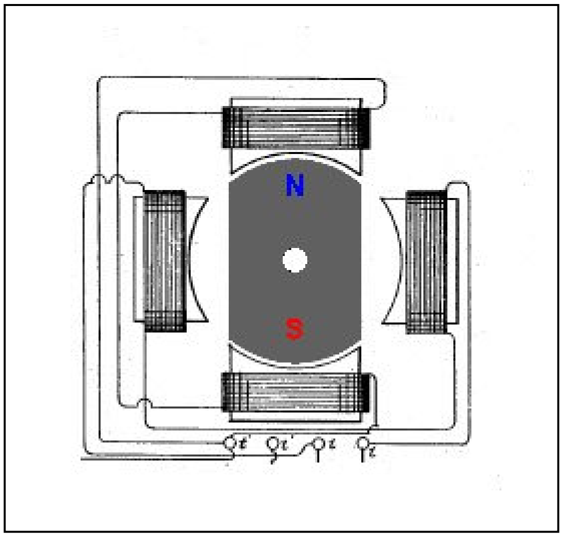
When a current carrying wire is placed in a magnetic field, the interaction of the magnetic field around the wire and the external magnetic field produce a force on the wire that tends to move the wire in such a way as to lower the flow of current. This is referred to as the "back EMF" or reverse electro-motive force.

When a wire that is connected to a complete circuit is placed in a magnetic field and physically moved perpendicular to that field, a current is induced in the wire that produces a force on the wire that makes moving it in its original direction more difficult. This is referred to as the "back MMF" or the reverse magneto-motive force.

In the first instance, the motion of the wire impedes the flow of current by inducing a reverse voltage. In the second instance, the flow of current impedes the motion of the wire by producing a magnetic repulsion against the external magnetic field. Lenz believed these two phenomena were reciprocals of each other and that their appearance supported the "Law of Conservation of Energy." Satisfied by his discovery, he looked into it no further.

So, this defines the specific arrangement of materials that must be avoided! We definitely do not want to move a current carrying wire directly in front of a magnet!

The question is, **what can we do** to produce electric induction and minimize how much reverse mechanical force it creates in the generator? Well, one simple variation of these components is shown on the next page, where coils are wound on iron pole pieces in the presence of a rotating magnet. While this seems remarkably similar and only sort of "inside out" of the original configuration, it does provide a number of new features that allow us to modify the appearance of Lenz's Law.



The first difference has to do with the appearance of mechanical force. In the first arrangement, if there is no current flowing in the wire, there are no mechanical forces produced at all. In this new arrangement, if there is no current flowing in the wire, the rotating magnet is still attracted to the iron in the pole pieces.

So, for instance, in the diagram on page 43, if the magnet approaches the coil, but the coil is not connected to the meter or anything else, then no current is induced in the coil and no magnetic resistance appears in response to the movement of the magnet. In that set of circumstances, the magnet is not attracted or repelled by anything else in the system, whether it is moving or not.

If, however, we introduce some iron into the coil, now there is a force produced on the magnet even if no currents are being generated! Also, this new magnetic force is a "universal attraction" in that the magnet is attracted toward the iron as it approaches AND it is still attracted back toward the iron as it tries to leave.

This arrangement of materials produces a set of forces that essentially cancel each other out to produce "no net force" on the movement of the magnet as it passes the iron pole pieces. But, "no net force" is completely different than "no force." This situation is quite deceptive and most engineers believe that the second arrangement of components is identical to the first in all operational characteristics, but it is not.

So, this gives us two simple processes to start engineering the appearance and/or the avoidance of Lenz's Law. The first is by winding coils of wire around stationary iron pole pieces that are either magnetized or de-magnetized by moving magnets past them. The second is by controlling WHEN electric currents are allowed to flow in the wires.

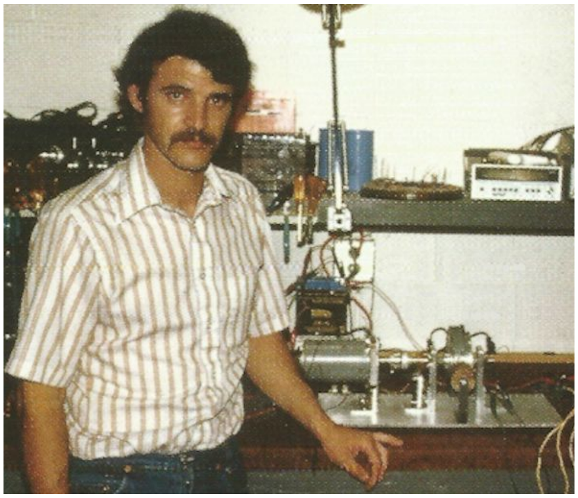
This is what John Bedini figured out in the early 1980s. Remember what he said:

> "I have run some tests in my lab and discovered that certain types of energizers, generators and alternators **do what we need**."

And what does he say we need?

> "The waves we want to generate
> are like those that come from old DC generators,
> **with the exception of armature drag**, bearing drag and no excited fields."

Ideally, he was looking for a generator that could produce DC pulses with a radiant spike (like from the sparks at the commutator) while producing a minimum of mechanical drag on the rotor, have low bearing losses, and eliminate excess energy use in the "field windings" by replacing them with permanent magnets. "Energizer" is the name he gave to any electric generator that operated with all or most of these parameters.



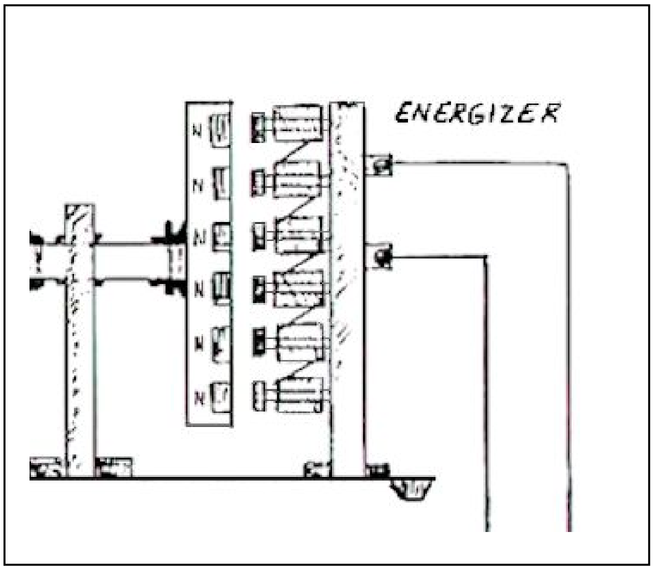
Here is a picture of John next to one of his working prototypes in the early 1980s. The unit has an electric motor on the left and the "energizer" on the right. This picture shows the unit without the flywheel.

Chapter Six

The Simple Low-Drag Generator

In the previous chapter, we looked at the theoretical possibility of building a generator that minimizes the appearance of mechanical drag (the reverse motoring effect) while it is producing electric current. In this chapter we will look closely at the design of the simple "energizer" that John Bedini developed in the 1980s that accomplished this goal.

Basic Configuration



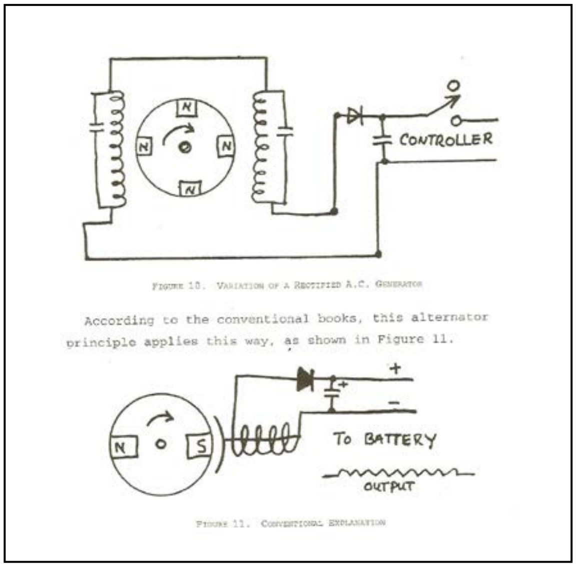
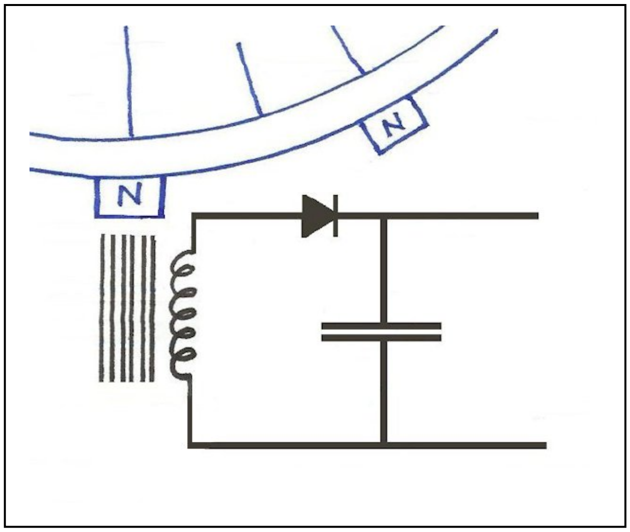


FIGURE 10. VARIATION OF A RECTIFIED A.C. GENERATOR

According to the conventional books, this alternator principle applies this way, as shown in Figure 11.

FIGURE 11. CONVENTIONAL EXPLANATION

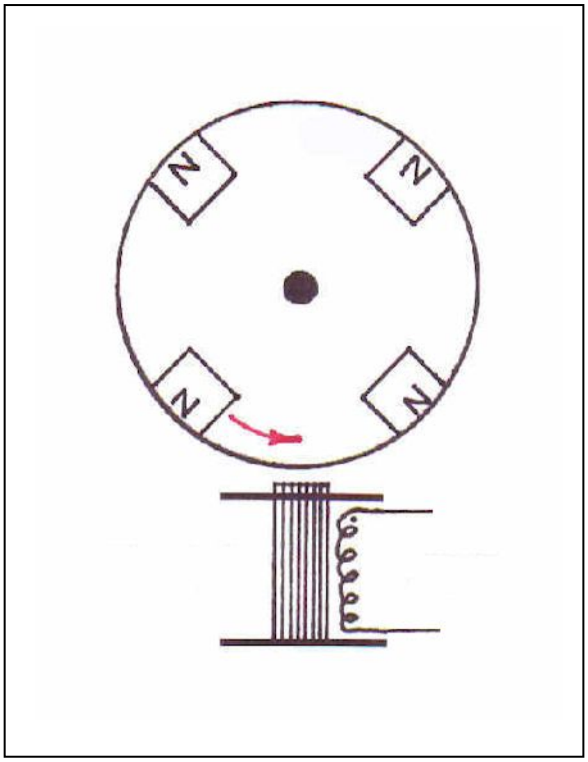
These two images are taken from John's original book titled **Bedini's Free Energy Generator**, published in 1984. In the first image we can see that the "energizer" appears to be made from a wheel with North facing permanent magnets on it directly in front of a structure holding a number of coils of wire with a core material that crudely looks like steel bolts. In the second image, two basic arrangements are shown with the lower one showing what appears to be a wheel with two magnets on it facing a coil of wire wound on some core material, presumably iron. The coil is connected to a simple circuit consisting of a diode and a capacitor.



To make these ideas clear, the next image simply shows a coil of wire on an iron core facing a wheel with some North Magnets on it and connected to a simple circuit consisting of a diode and a capacitor. So this is the basic "Energizer" construct and method.

This is the "basic configuration" of an "energizer" or a "low drag" generator. Next, let's see WHAT this does and WHY it works.

Analysis of Lenz's Law Forces

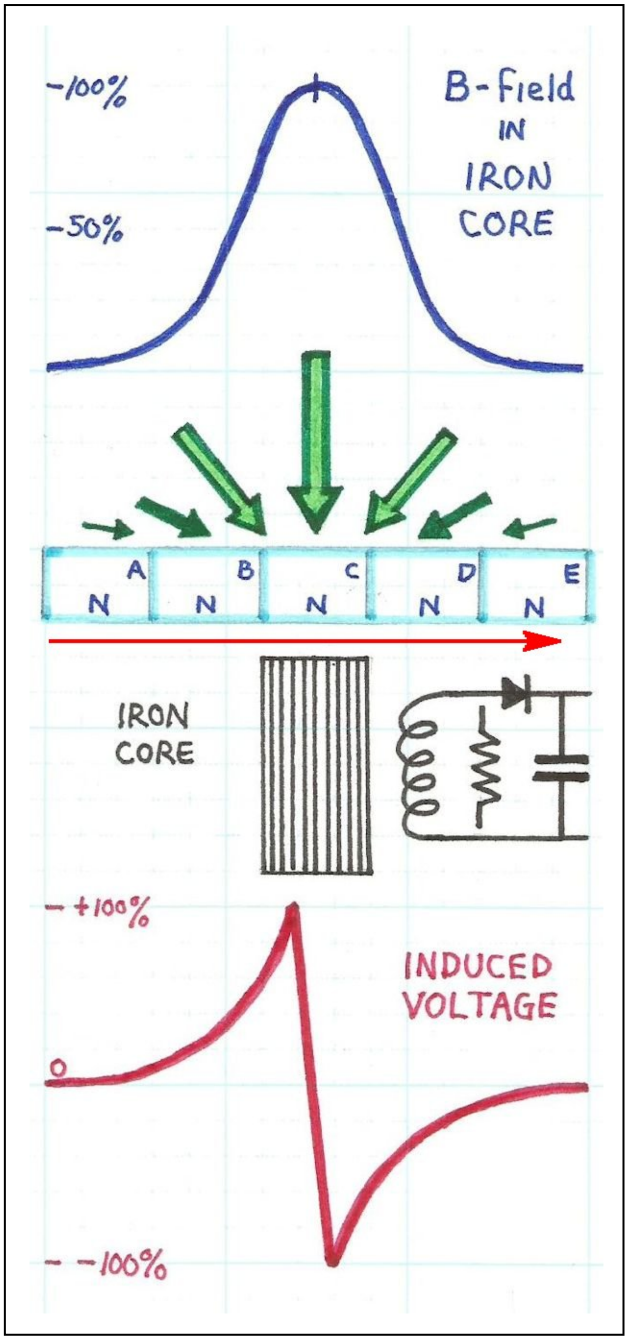


In order to simplify this, just imagine this arrangement of components. At the bottom, there is an iron core with a coil of wire wrapped around it, and above the iron core, there is a wheel with a series of North facing magnets on it. The **RED** arrow represents the direction of rotation on the wheel.

As the wheel rotates, the magnets move passed the iron core and produce a complex series of events which include:

1. magnetization of the iron core
2. attraction forces that act on the wheel
3. voltage production in the coil due to the changes of magnetic flux in the iron core

The drawing to the right illustrates all of these interactions.



In the middle of the drawing, the iron core of the coil is shown as a **Black Rectangle** with a number of vertical, parallel lines in it.

To the right of the iron core, the coil is shown connected to the diode and capacitor circuit, but also the symbol for a resistor is shown unconnected but close by.

The **Blue Boxes** above the iron core represent a permanent magnet on the wheel, and five possible positions it could be in as it passes the iron core. The **Red Arrow** represents the direction the magnet is moving through Positions A to E. The N represents the North Pole of the magnet facing the core.

Above the **Blue Boxes** are a series of **Green Arrows**, which represent the mechanical force applied to the wheel as the magnet passes the iron core. The **Green Arrows** point in the direction of the mechanical force, and the size of the **Green Arrows** represents the relative strength of the mechanical force in that position.

Above the **Green Arrows** is a **Blue Graph** which represents the strength of the magnetic field in the iron core. Finally, at the bottom of the image, the **Red Graph** represents the Voltage Induced in the coil as the magnet moves passed the iron core.

So, this is the complex "snapshot" of events that occurs each time a magnet passes the iron core. Let's go through each of these processes, one by one.

The **Blue Graph** shows the strength of the magnetic field in the iron core as the magnet moves from Position A to Position E. The magnetic field in the core starts magnetizing slowly when the magnet is in Position A, then as the magnet arrives at Position B, the magnetization rises rapidly and peaks when the magnet is directly over the iron in Position C. As the magnet moves passed this position, the magnetization of the iron falls off rapidly until the magnet reaches Position D, and continues to weaken as the magnet moves to Position E.

The mechanical force applied to the wheel follows a similar profile with regard to strength, but not with regard to direction, as illustrated by the **Green Arrows**. So, the force on the wheel when the magnet is in Position A is weak, but it is parallel to the direction the wheel is turning, (**Red Arrow**) and it ADDs to the momentum of the rotation. This is a positive motoring force applied to the wheel by the permanent magnet.

This positive mechanical force continues to ADD to the rotation of the wheel as the magnet moves through Position B and all the way up to Position C. Even though the magnet continues to contribute a significant positive force on the wheel in its forward direction, the actual force vector of the attraction of the magnet to the iron core is progressively swinging more and more vertical in its orientation.

When the magnet is in Position C, the magnet is not applying any force on the wheel to either promote or retard its rotation, but its attraction is at its maximum. At this position, the magnetic force on the iron is 100% vertical, meaning it is 90° out of phase with the plane of rotation.

As the magnet moves passed Position C, the mechanical forces on the wheel reverse, and now begin to retard the forward motion of the wheel.

As the magnet moves from Position C to Position E, it produces a "reverse motoring action" on the wheel that is essentially of the same magnitude as the "forward motoring action" of the magnet moving from Position A to Position C. So, the entire movement of the magnet past the iron core produces "no net torque" on the wheel, as long as no current is generated in the coil and no Lenz Law forces are produced.

Even if no current is produced in the coil, a voltage is induced in the winding in response to the magnetization of the iron core. This is shown in the **Red Graph** in the illustration on page 51. The Induced Voltage tracks the CHANGES in the strength of the magnetization of the iron core.

So, as the magnetization of the iron core rises rapidly from Position B up to Position C, the Induced Voltage rises rapidly as well. But when the magnetization of the iron core reaches its highest value at Position C, the CHANGES in magnetization stop, and the Induced Voltage drops to zero.

Then, as the magnetization of the iron core starts dropping, this represents a CHANGE in magnetic flux in the opposite direction, and so the Induced Voltage reverses and rapidly rises to its highest negative value. As the magnetization of the iron core falls rapidly moving toward Position D, the negative voltage of the coil also drops. As the magnet moves to Position E, the iron core loses all of its magnetic field and the Induced Voltage returns to zero, as well.

This completes the analysis of the behaviors of the magnetic fields and the mechanical forces they produce. Now, let's look at what happens when currents are induced in the coil and what changes they produce.

Changes of Drag Co-Efficient with Different Loads

While standard electric generators produce a linear relationship between electrical loads and mechanical drag forces, this design of generator does not. That is why this design of generator is sometimes referred to as an "indirect induction" generator, because of the buffering effect created by the addition of the stationary iron cores.

Direct induction generators exhibit a linear relationship between current production and the appearance of mechanical drag or reverse motoring torque. Indirect induction generators exhibit a non-linear relationship between current production and mechanical drag.

As an example, under one set of tests run on the Extra Coil Generator on the 2014 Conference Demonstration Model, the following data was collected:

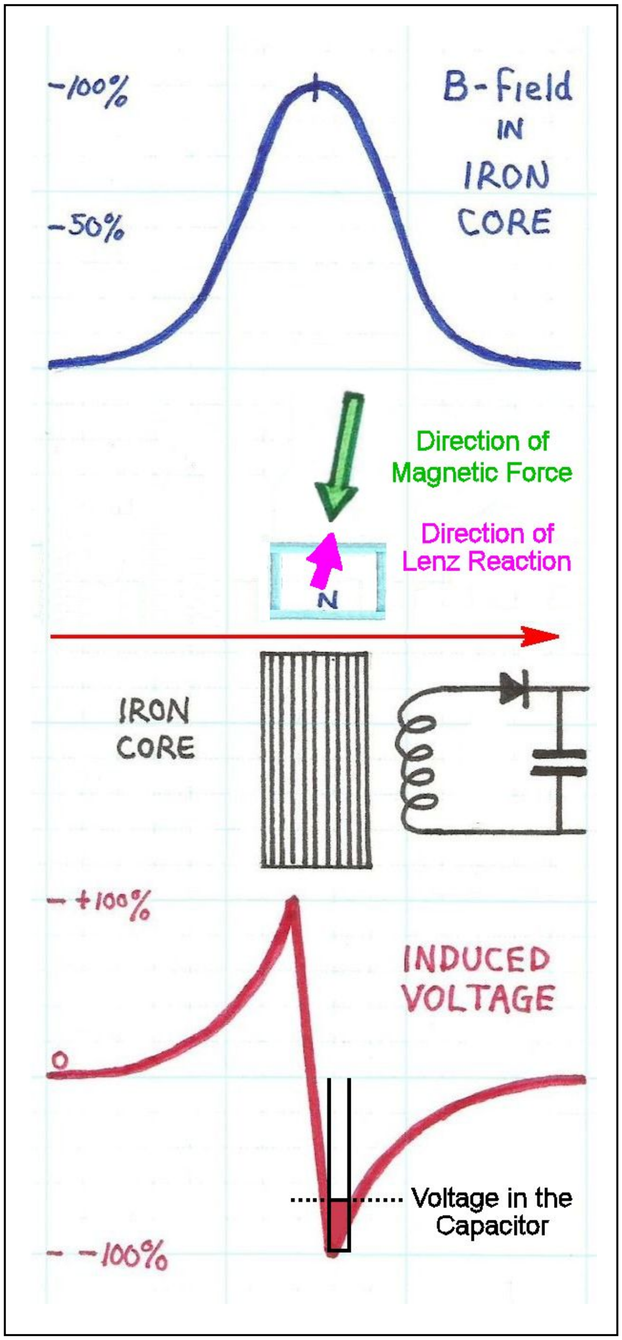
Wheel Speed when Generator had No Load (Open Circuit)	370 rpm
Wheel Speed when Generator had 40 LED Load	365 rpm
Wheel Speed when Generator had 0 Ω Load (Short Circuit)	360 rpm
Wheel Speed when Generator had 100 Ω Load	Stall
Wheel Speed when Generator had 300 Ω Load	Stall
Wheel Speed when Generator had 1,000 Ω Load	360 rpm

A standard generator exhibits maximum speed with an Open Circuit Load and stalls with a Short Circuit Load. Our test generator exhibits nearly the same Top Speed for Open Circuit and Short Circuit Loads, and stalls with medium loads. This demonstrates that the generator is NOT a "low drag" generator under all circumstances, but that it can produce significant current and low drag under specific conditions.

Loading Effects of the Diode and Capacitor Circuit

From the data shown above, you can see that the loading effects of lighting 40 LEDs, using the diode and capacitor circuit, only drops the speed of the SG wheel by 5 rpm. This is a loss of only 1.3% of the speed and it sits right in the middle of the Open Circuit and Short Circuit loading effects.

This is nearly an ideal loading characteristic for the generator in its present configuration. So, how does this work?



This image is a "snapshot" of the timing of current production for charging the capacitor. The diode is connected to the coil so that it clips the trailing voltage peak as the magnet begins to leave Position C.

This allows 100% of the attraction forces to add to the forward momentum of the wheel while the magnet approaches the iron core as no current flows during this period.

The voltage in the capacitor is drawn down by the load to just below the peak voltage generated by the coil. As the coil voltage rises above the voltage in the capacitor, current flows through the coil, filling the capacitor AND producing a mechanical Lenz Law reaction against the external magnetic field.

The period during which the current flows is defined by the black area indicated on the Induced Voltage graph. The Lenz reaction produced by this current is applied back toward the external magnetic field in exact opposition to the angle by which it is induced. In this case, it reduces the permanent magnet's attraction to the iron core, which is still mostly vertical in its orientation at this moment.

So, Lenz's Law has been satisfied exactly as required! It's just that in this configuration, the geometry does not apply the reverse mechanical force directly against the forward progress of the rotation of the wheel, which is still indicated by the **Red Arrow**.

Now we can see the genius of John's little circuit. It automatically regulates when current is produced to a select "window of opportunity" where both the voltage and the current generated can be the highest for the least possible mechanical drag. When built properly, this is the quintessential event that the Energizer is designed to produce repeatedly.

The design of this machine has been in the public domain for 30 years. The only reason more people do not understand this technology is that almost no one ever built it and therefore, no one actually observed what it did.

Variations on the Design

There are dozens of modifications that can be made to this arrangement of components to improve its operation. This is a short list of some of them:

- A larger wheel makes the Lenz reaction even more vertical
- More closely spaced magnets produce more events per revolution
- A larger capacitor narrows the period of current production
- A larger flywheel maintains top speed more consistently
- A well regulated top speed reduces electric motor input

So, size definitely enhances all of the benefits of the phenomena being captured here. OK, let's put all of the pieces together and look at the entire machine, including the largest model of John's original energizer design ever shown in public.

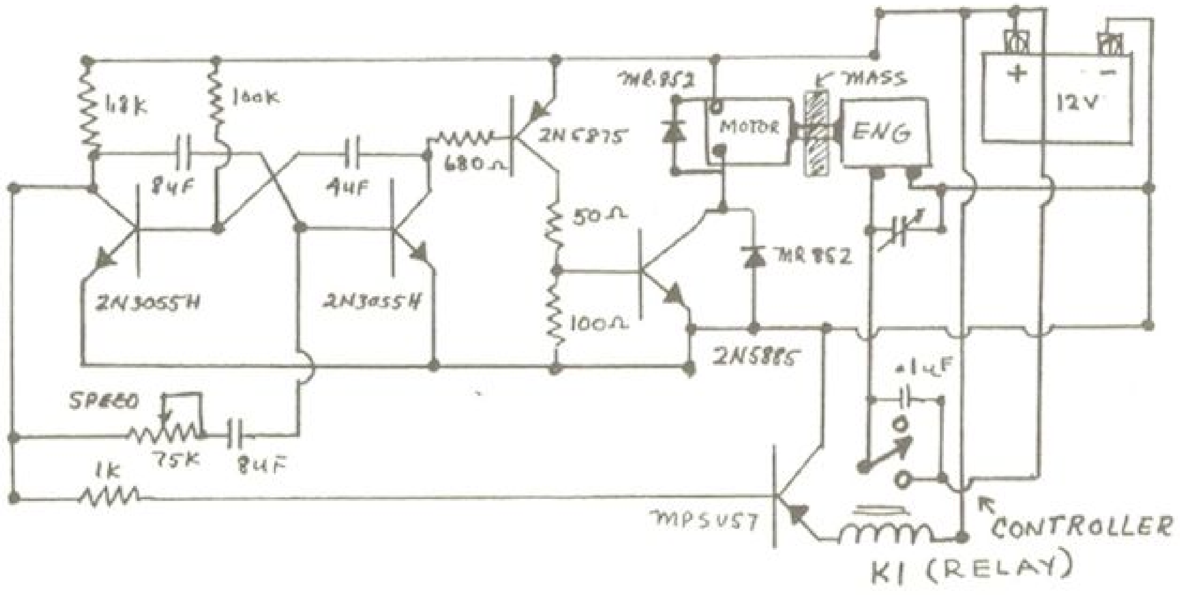
Chapter Seven

Detailed Analysis of the "Watson Machine"

A Little History

Before John published his booklet in 1984, dozens of experiments had been run. So, he knew it worked. The problem was that he didn't know exactly WHY it worked. Tom Bearden suggested an operational theory at the time, which was all they had to go on. So the theory of the "phi-dot current" and the idea that "the battery charged itself" came from that period. John has always said that "there are many different ways to explain this theory" and the simple idea of harnessing a "low-drag" generator is one of them.

Here is the schematic of the "original" circuit and controller that John used.



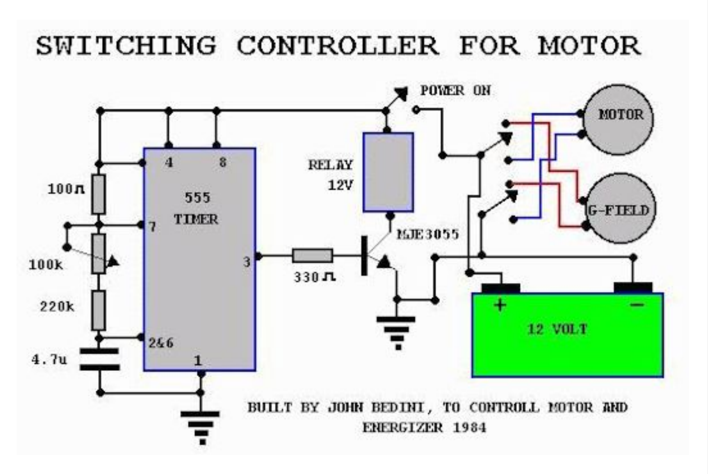
Original Circuit Controller for the Bedini Free Energy Device

The machine was an electric motor, a flywheel and an energizer. It ran and charged a single 12 volt lead-acid battery. The circuit was a flip-flop timer made from discrete electronic parts that ran the motor from the battery part of the time while the energizer charged a capacitor. Then, the circuit disconnected the motor from the battery and discharged the capacitor into the battery followed by a bunch of spikes directly from the energizer. At that point, the cycle started again. The timing was asymmetrical and the repetition rate of the flip-flop was changeable. While the motor was turned ON and OFF directly from a transistor, the capacitor was discharged through a mechanical relay contactor.

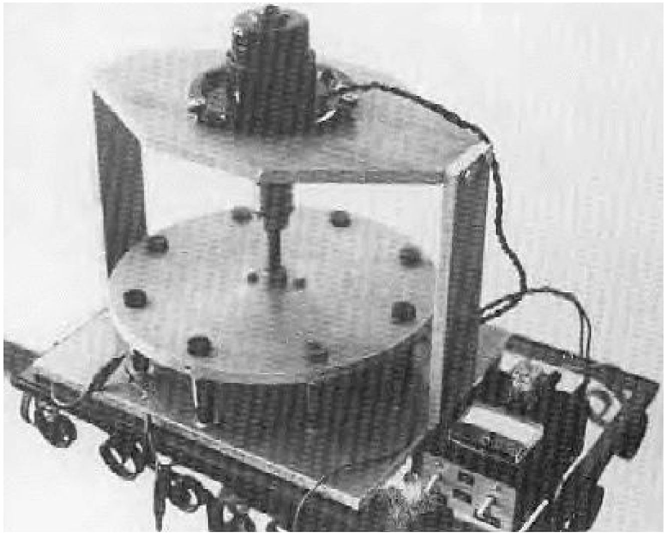
Since the Energizer could charge the capacitor with low drag, running the machine at "top speed" for the motor allowed it to draw the least energy from the battery. The size of the capacitor was chosen to give the battery a significant reverse current surge to optimize charging and the size of the flywheel was chosen to maintain the highest possible speed during the capacitor discharge phase when the motor wasn't under power.

To get the system to work, these various parameters needed to be fussed with a bit to find the best balance, and then the speed at which these phases were switched was the last thing to be fine tuned. John could always tune his units up, but most others had trouble with this.

After John published his book, Jim Watson contacted him, and they had numerous discussions on the phone. Jim wasn't very familiar with electronics, and asked John to develop an even simpler control circuit. In response to this, John developed this 555 based timer/relay circuit.


SWITCHING CONTROLLER FOR MOTOR
POWER ON
MOTOR
G-FIELD
RELAY
12V
MJE3055
100Ω
555
TIMER
4
8
7
3
2&6
1
100k
220k
4.7u
330Ω
+
−
12 VOLT
BUILT BY JOHN BEDINI, TO CONTROLL MOTOR AND ENERGIZER 1984

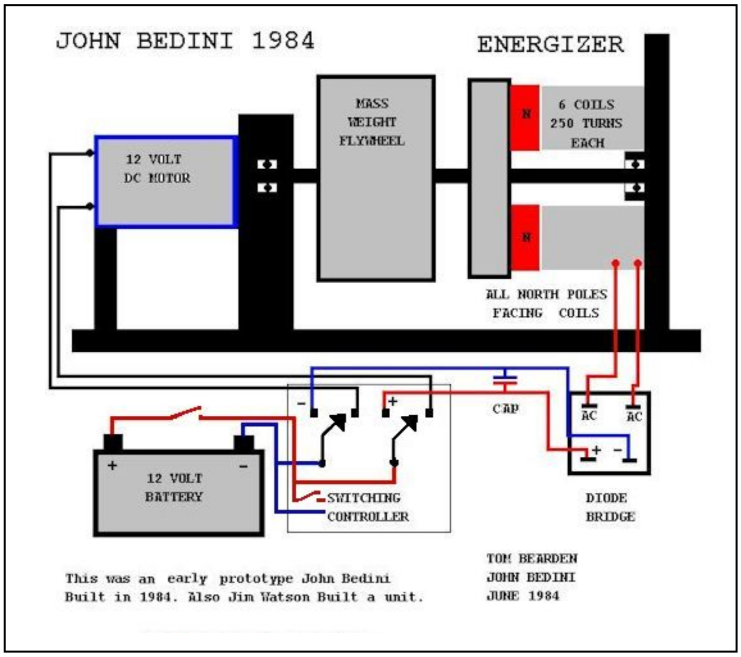
Using this simpler circuit controller, Jim Watson built his first machine.



That model is shown here.

A 12 volt automotive fan motor turns a flywheel with eight Ceramic #8 magnets in it. The magnets face eight energizer coils mounted to a base plate using steel bolts as the coil cores. All Energizer coils are connected in series.

All of the circuitry, including the capacitor, is in the box to the right, with the mechanical relay visible on top. The two switches allowed the motor to run directly from the battery to get the unit up to speed, and then be put in "run mode" so that the circuit automatically switched the functions as described before.



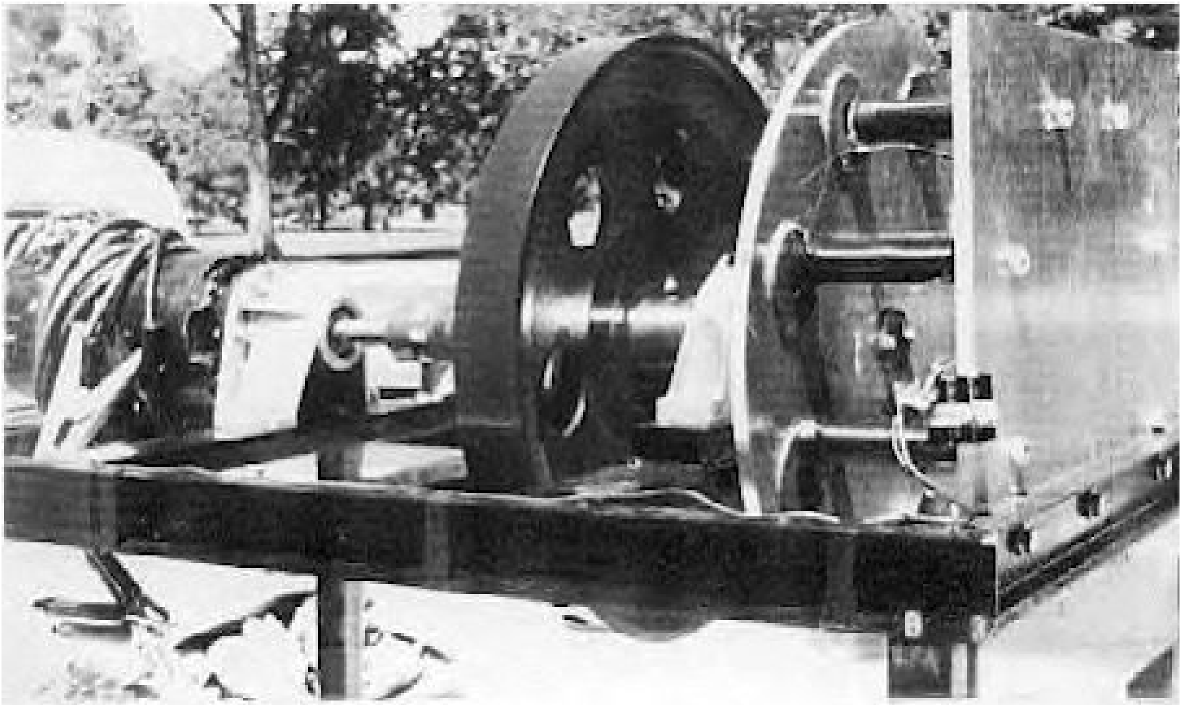
The basic equivalent circuit is shown here. The switch over the battery turns the unit ON. This connects the battery directly to the motor through the relay when it is OFF. The second switch turns the relay switching controller ON and OFF.

Also, you will notice that the Energizer is connected to the capacitor through a "full wave bridge" rectifier, whereas a single diode has been discussed before. The FWB simply clips both the forward and trailing peaks of the Energizer wave form to charge the capacitor. This doubles the output for a little more drag on the system. With a standard motor and flywheel arrangement, this trade-off works fine.

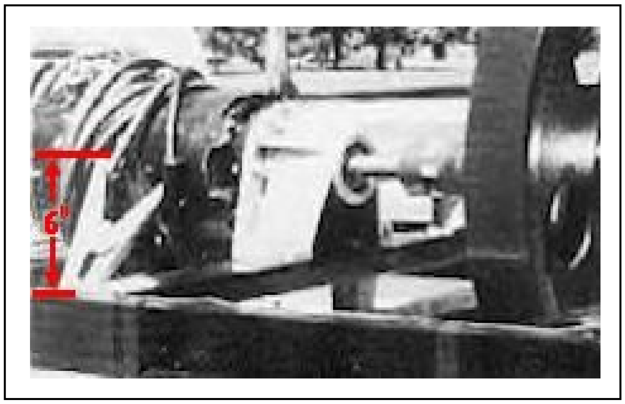
Essentially, all of these pictures and diagrams have been on John's website since 1996, and none of this deviates from the fundamental method that was published in his 1984 book titled **Bedini's Free Energy Generator**.

The Machine that Rocked the Boat

Jim Watson was sufficiently impressed with his first model that he decided to build a bigger one. In the run up to the Tesla Centennial Symposium in Colorado Springs that summer, Jim would only tell John that he was working on a "surprise" for the conference. Jim was an accomplished automobile mechanic, so working on big machines was well within his level of expertise. Here is a picture of what Jim Watson demonstrated for the attendees at the first Tesla Society Conference in the summer of 1984.



The Scale of this Machine



There has been a lot of speculation about this on the internet, so it seemed like a good time to address the real size of this machine. There are almost no clues in the picture as to how big it is. The only scale that can be reasonably inferred by the image is based on the jumper cable clamp bracketed by the **RED** marks. If we assume that that clamp is 6 inches long, all other lengths and diameters may be inferred from it.

Jumper Cable Clamp:	6" Length (15.36 cm)
I-Beam:	4" Height (10.24 cm)
I-Beam Frame:	6 ft Length (184.32 cm)
	2.5 ft Width (76.80 cm)
Drive Motor:	6" Diameter (15.36 cm)
	9.25" Length (23.68 cm)
Shaft emerging from gear box:	1.25" (3.20 cm)
Flywheel	24" Diameter (61.44 cm)
	2.5" Rim (6.40 cm)
	2.5" Shaft (6.40 cm)
Coils	6.6" Length (16.89 cm)
	2" Diameter (5.12 cm)
Ring Magnets	5.25" Outside Diameter (13.44 cm)
	2" Inside Diameter (5.12 cm)
	1.5" Thickness (3.84 cm)
Energizer Wheel	25" Diameter (64.00 cm)
	0.75" Thickness (1.92 cm)
Capacitors	2.8" Height (7.17 cm)
	1.42" Diameter (3.63 cm)

Construction Details

The electric motor was a 24 volt, Series Wound, high speed motor, originally used as an aircraft starter motor. This motor was connected directly to a gear reduction box. The exact gear reduction ratio is not known, but is presumed to be between 6-to-1 and 10-to-1. The shaft emerging from the gear reduction box is visible and measured as 1.25". This shaft goes directly to a shaft coupler and mates to the 2.5" shaft going through the Flywheel.

The Flywheel is supported by two large bearings, one on either side, with only the nearest one visible in the picture. The target speed for the Flywheel is 500 rpm. Its construction is Cast Iron, presumably refurbished from an old steam engine. Its weight is 102 lbs (46 Kgs).

The Energizer wheel is most probably a ¾" thick Aluminum Plate, which rides on the end of the 2.5" shaft beyond the second bearing. The Ring Magnets are 1.5" thick, and therefore stick out about .4" on either side of the wheel. The Ring Magnets are 5.25" Diameter speaker magnets, made of #8 Ceramic Barium Ferrite material. There are 7 Ring Magnets on the wheel.

The back plate of the Energizer is also an Aluminum Plate. The coil cores are Steel Bolts connected directly to the plate. There are 8 coils mounted to the plate facing the 7 Ring Magnets on the wheel. Since the coils are out of phase with each other, each one has its own rectifier feeding the capacitors.

There are three capacitors that are about 15,000uf each, wired in parallel. The target voltage of these capacitors at discharge is 50 volts DC.

Not shown are the two 12 volt batteries wired in parallel, the control circuit timer and the mechanical relay that provided the switching. The schematic for the large machine is identical to the schematic for the small machine. The relay system was made of automotive relays, rated for about 50 amps.

Other Unique Features

The Ring Magnets moving passed the coils produced an unusual wave form. As the first side of the ring approached the coil, the voltage would swing to a Positive peak. Then, as the coil was fully aligned with the first side of the ring, the voltage dropped to zero. As the coil entered the center of the ring, it produced the first Negative peak, but then quickly reversed again as it engaged the second side of the ring, producing a second Positive peak. This was followed by a second Negative peak as the second side of the ring magnet left the area of the coil. So, there were four peak voltage events per interaction of each coil with each ring magnet.

At 500 rpm, there would be 8.33 revolutions per second, and 8 coils being energized by 7 ring magnets each revolution producing 4 peak voltage events per interaction. This produced 1,865.92 charge impulses per second to charge the capacitors. (8 × 7 × 8.33 × 4 = 1,865.92)

Remember, the coils were 6.6 inches long and 2 inches in diameter, and they were producing 1,866 peak voltage events per second to charge the capacitors!

John reports that the relay timing was set for "once per second" switching, meaning that the machine would run the motor from the battery for one second while the capacitors were being charged. Then the relay would switch, and the machine would run from the flywheel while the capacitors discharged into the battery followed by the rest of the whole second of Energizer impulses going straight to the battery. At the end of the second second, the relay would switch again, and the cycle would repeat.

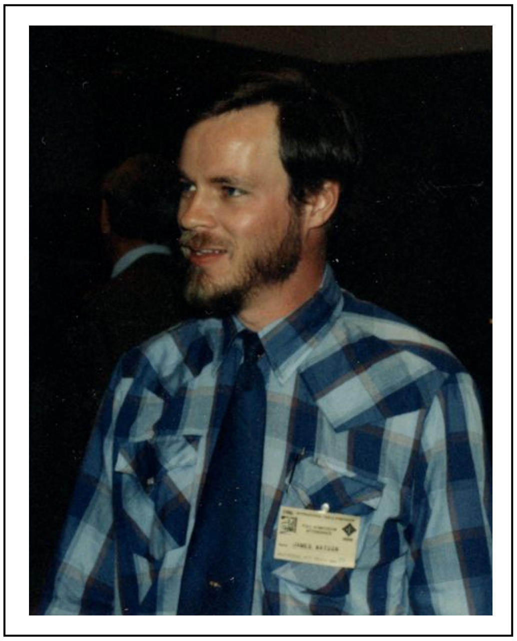
The method allows 100% of the output of the Energizer to be transferred to the battery while the motor runs from the battery only 50% of the time. The motor running at high speed while the very large flywheel ran at lower speed provided a very stable operation to the Energizer and maintained a relatively low power requirement to the motor.

The Myths and the Facts

Based upon the testimony of multiple eyewitnesses, these are very close to the dimensions of the machine. In recordings taken from the presentation, the weight of the flywheel was given by Jim Watson as 102 lbs. This makes the machine large, but quite a bit smaller than many have guessed.

So this establishes the size of the machine as closely as possible from the photograph and from other sources. Remarkably, Jim Watson did not let John inspect the machine at close range.

Jim Watson's large model of John's "Free Energy Generator" design was shown at the Tesla Centennial Symposium, held at Colorado College, in Colorado Springs, on August 9th through the 12th, 1984. The published ***Proceedings of the Tesla Centennial Symposium, in the Light of Modern Physics*** does not mention either Jim Watson's demonstration or John Bedini's presentation on his "Cigar Box Tesla Switch." Apparently, to be included in the published "Proceedings" document, the presentations had to be written up ahead of time, and Jim's and John's remarks were essentially spontaneous in nature.



While the MACHINE seems to have disappeared immediately after this demonstration, Jim Watson did not. Reliable witnesses who visited Jim at his home soon after the conference, did not see the large model there. In fact, no one has reported seeing the machine since its original demonstration in August of 1984. No other photographs of it have ever surfaced, either. But here is a photograph of Jim Watson attending the 1986 Tesla Symposium, taken by Jeane Manning.

Two reliable witnesses also saw him at a conference he attended in a less conspicuous way in Denver in 1990. Regardless of these multiple appearances, no one was ever able to get him to discuss the machine demonstrated in 1984. Apparently, "something" happened that accounts for the machine's disappearance and Jim's silence, but exactly what that is, nobody knows.

In some ways, John did not understand all of the interest in Jim's machine. First, it was nothing more than the exact design he had developed and published earlier that year, except it was bigger. Second, when the unit was running, the relay system was rapidly overwhelmed by arcing and John doubts whether the unit could have run for more than 20 minutes before a complete "meltdown" of the relays. This feature made it an interesting "demonstration," but it was not a practical stand-alone power supply in its present form.

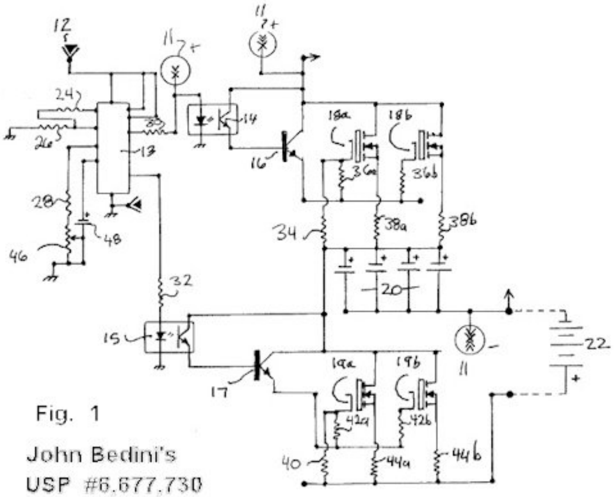


Fig. 1
John Bedini's
USP #6,677,730

To put this into perspective, here is Figure 1 from John Bedini's US Patent #6,677,730. It shows a solid-state circuit for charging a capacitor and discharging it into a battery.

One of the operational models of this design used a group of capacitors with a combined capacitance of 120,000uf, charged to about 25 volts. It was discharged about once a second through six parallel N-channel MosFets into a large 12 volt battery.

In this situation, the initial surge of current into the battery was well over 5000 amperes, actually "pegging" every meter and scope probe John put on it. Even with active cooling, the MosFet devices were burning out within a few hours of run time. The battery, on the other hand, would move immediately into a "cold boil" condition, and the voltage on a 100 AH battery would jump half a volt every time the capacitor discharged.

The Watson Machine was discharging 45,000uf capacitors charged to about 50 volts, once a second into the batteries. That actually represents more Joules per discharge than John's circuit. Doing this across a mechanical relay system rated at 50 amperes just wasn't going to last very long!

To this date, no definitive test data has ever been provided concerning the operational performance of the "Watson Machine." The reality is, no one really knows what it was capable of. It is reasonable to deduce, however, that the large aluminum plates, the coil cores made from steel bolts, and the extremely simplistic switching limited its performance in significant ways. In spite of these weaknesses, visually, the machine seemed to "self-run" during a short demonstration and appeared quite powerful, with its large flywheel running at top speed and battery gaining in voltage!

Shortly after John got home from this Symposium, he was threatened and told "not to work on these technologies" any longer. These threats he took very seriously and it convinced him to change the course of his work in this field in a number of specific ways.

First, he decided that he would not attend any more of these types of conferences. Second, he decided to keep working on these technologies, but not publish anything more on the "self-running" systems. Third, he decided that he would not build any models that were large enough to be a practical power supply, which he certainly knew how to do. These decisions remained in place for 20 years, until 2004, when larger systems started being built and tested again, as well as the plans being released for the first "School Girl Motor" project on the internet.

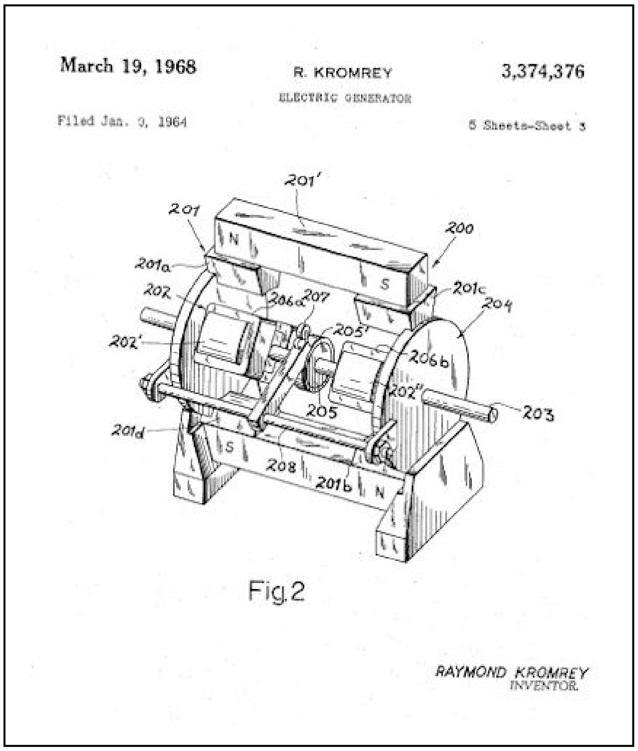
John also finally consented to begin appearing at a conference held in his local area in 2010, and more and more accurate information about his discoveries has been released every year since then.

Chapter Eight

Detailed Analysis of the "G-field Generator"

John has always said that "certain types of generators do what we need" and that what we need is to produce electric current with a low mechanical drag component. We have looked closely at the Energizer construct, which is a rotating magnet facing a stationary iron core with a coil wrapped around it. But John also did extensive testing of a generator that had the inverse construct; that is, a rotating iron core with a coil wrapped around it moving passed a stationary magnet. This is the "G-field generator."

The original design of this generator was developed by a Swiss engineer named Raymond Kromrey. Kromrey did extensive research and testing on this concept in the 1960s, and received US Patent #3,374,376 on the basic design in March of 1968.



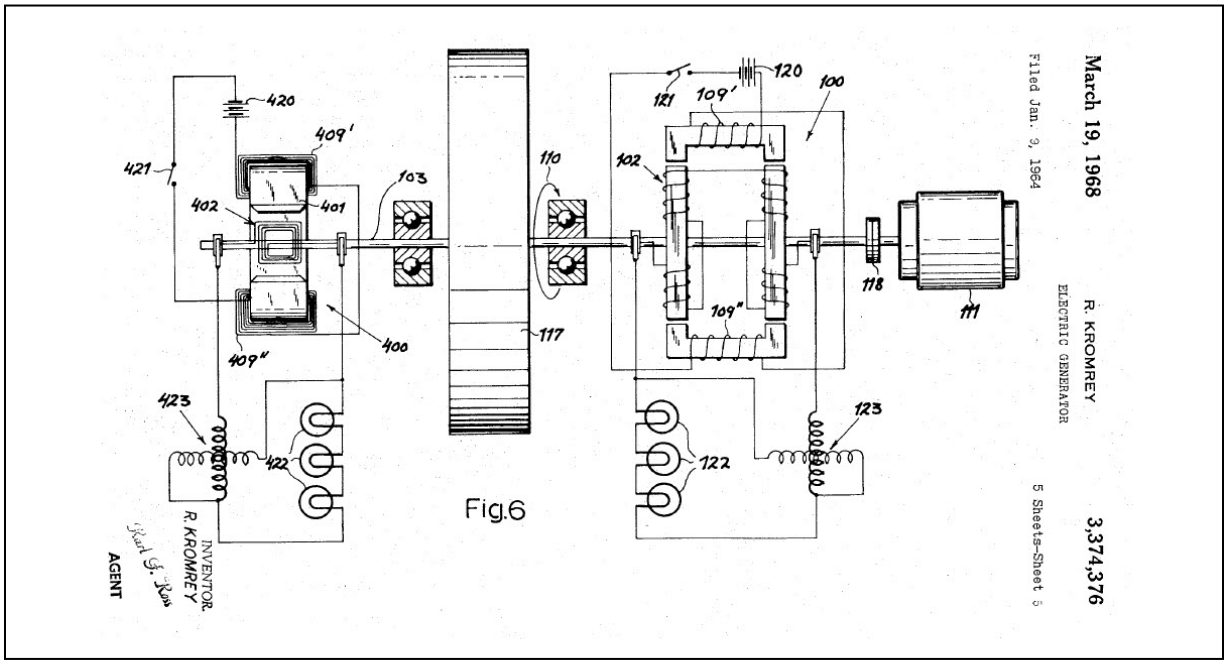
Here is an image from the patent.

The invention is titled "Electric Generator" in the patent. In other reports, Kromrey refers to it as the "Ferromagnetic Generator" and also as the "Molecular Generator."

Being a firm believer in the "Law of Conservation of Energy", he postulated that the energy gain produced by the machine was coming from an interaction with the Gravitational Field, but he also believed that the specific mass of the rotor was involved in this gain.

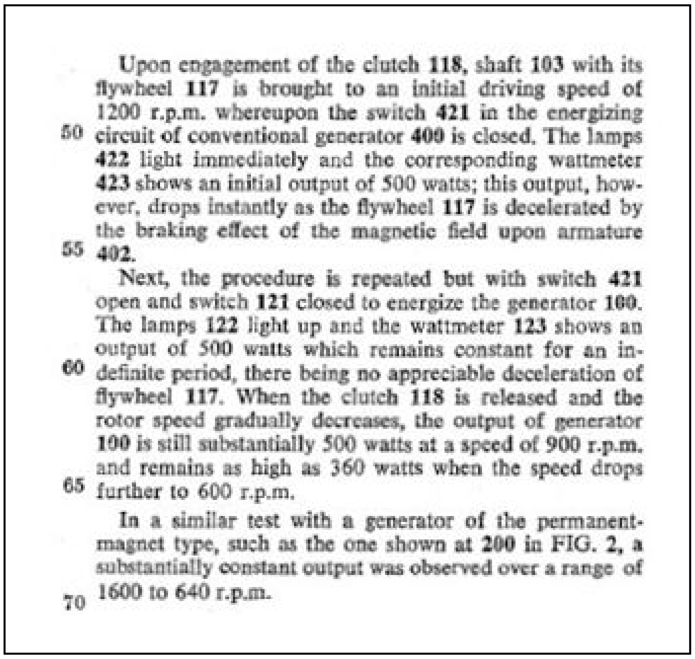
Summary of Operational Characteristics

The US Patent is written in a relatively simple manner, and the patent is granted on a single claim based on the physical design alone. There is no attempt to officially "claim" that the generator does anything unusual.



However, in the body of the patent, experimental data is offered that supports an extremely unusual analysis of the machine. Here is the image of Figure 6 from the patent, and the paragraphs from the patent text that explain it.

It describes a "side by side" test of a standard generator and the new generator with regard to mechanical drag under load.



Upon engagement of the clutch **118**, shaft **103** with its flywheel **117** is brought to an initial driving speed of 1200 r.p.m. whereupon the switch **421** in the energizing circuit of conventional generator **400** is closed. The lamps **422** light immediately and the corresponding wattmeter **423** shows an initial output of 500 watts; this output, however, drops instantly as the flywheel **117** is decelerated by the braking effect of the magnetic field upon armature **402**.

Next, the procedure is repeated but with switch **421** open and switch **121** closed to energize the generator **100**. The lamps **122** light up and the wattmeter **123** shows an output of 500 watts which remains constant for an indefinite period, there being no appreciable deceleration of flywheel **117**. When the clutch **118** is released and the rotor speed gradually decreases, the output of generator **100** is still substantially 500 watts at a speed of 900 r.p.m. and remains as high as 360 watts when the speed drops further to 600 r.p.m.

In a similar test with a generator of the permanent-magnet type, such as the one shown at **200** in FIG. 2, a substantially constant output was observed over a range of 1600 to 640 r.p.m.

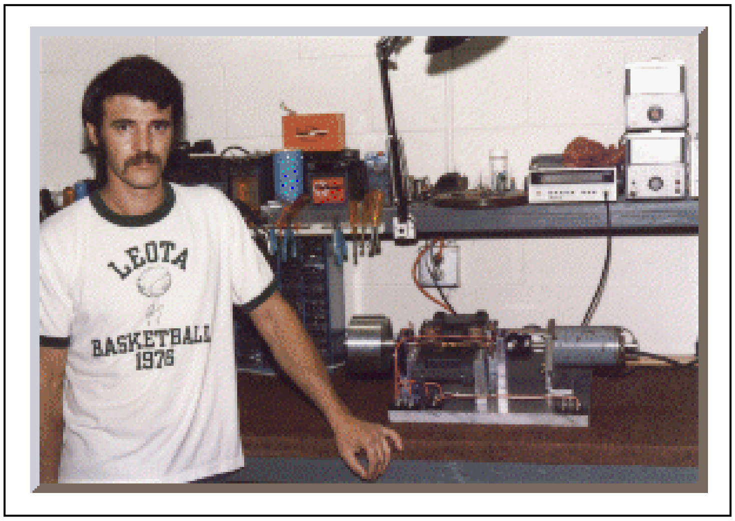
So here we see for the first time, in Kromrey's patent, the fundamental components of John's "Free Energy Device" consisting of an electric motor, a low drag generator and a flywheel.

A Little Back Story...

When John first discovered the Kromrey Patent, he knew it might hold the key to what he was looking for. He immediately attempted to contact the inventor in Switzerland. Unfortunately, by the time John did this, Raymond Kromrey had already died. He was able, however, to track down his surviving widow.

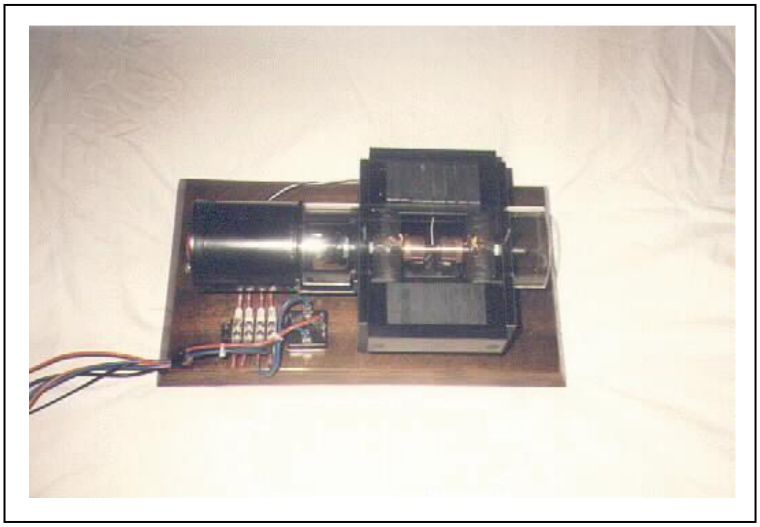
John explained to Mrs. Kromrey that he was interested in the generator and wanted to have her permission to do some further research on it. Much to his surprise, he found that Mrs. Kromrey hated the generator and that she was really quite bitter that it had "stolen" her husband from her in his last years. She told John he could do anything he wanted with it and not to contact her again.

John Bedini's Replications



Left completely on his own, John began to replicate the machine and see if he could duplicate the results Kromrey reported. Here is a picture of an early model of the "G-field Generator". He named it that because Kromrey believed the excess energy was coming from the Gravitational Field.

The early models proved that Kromrey was correct about the low drag characteristics of the generator. But there was something else that he hadn't mentioned. The machine was HORRIDLY LOUD when running. It made this deep, harsh growl sound like a Buzz Saw as the magnetic fields were cut. No modifications were ever found to quiet the thing down.



In spite of this, John tried to get more people interested in this technology by building and selling dozens of these fully operational models with a partner who eventually screwed him out of most of the money.

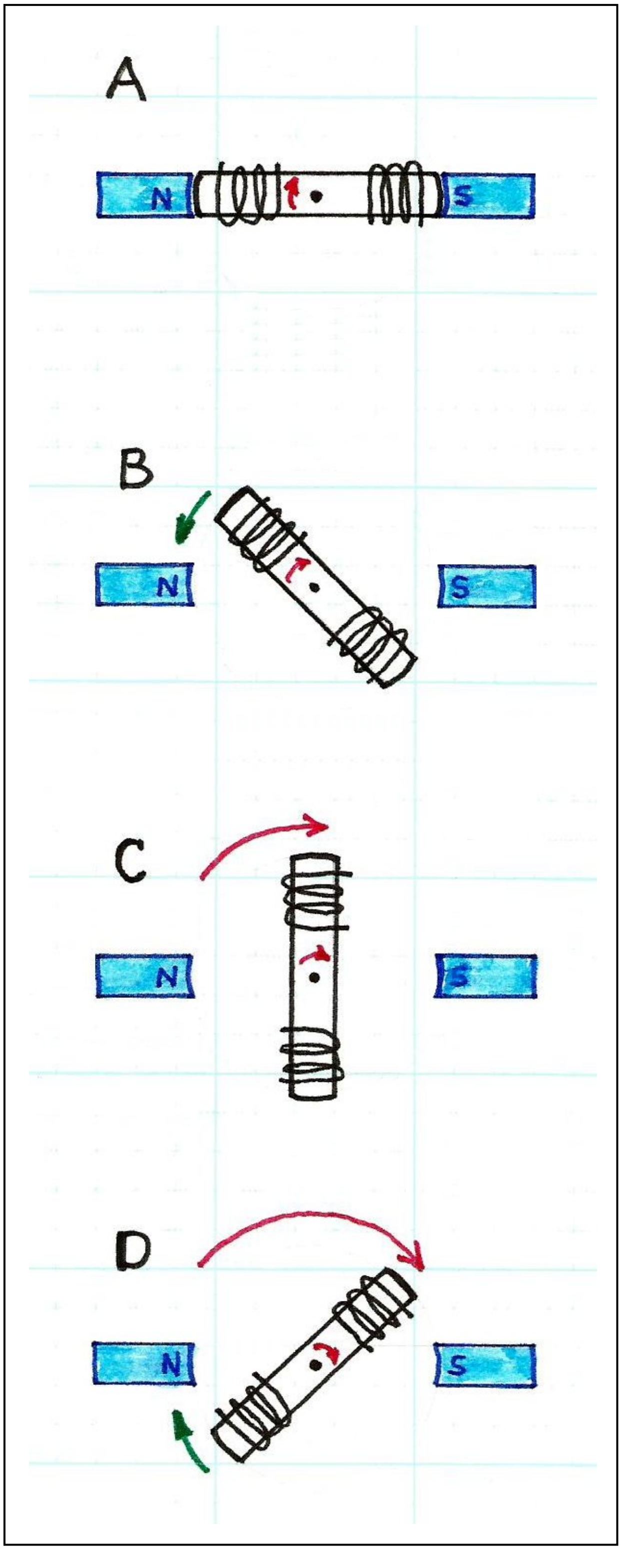
This was not working out the way John wanted it to!

The Electrical Engineering Department of one University on the East Coast purchased one of the generators, and then another nine, and tested them extensively. When pressed to give him some test data, they only told John two things; one, that they could "not teach this science to their students", and two, that,... oh by the way.... "it makes a good battery charger."

So here we see how John's work moved this technology forward. Kromrey knew the generator had very low drag under short circuit loads, but he had never attempted to take the output and use it to charge a battery, and he had definitely not thought of using the output to run the drive motor to make the system "self-run." These ideas developed gradually during John's research.

The other difficulty the Kromrey Generator had was that the electricity was generated on the rotor, which meant that the power could only be taken out of the machine using brushes or sliding contacts. Both commutators and brushes or AC slip-rings and brushes are stipulated in the patent.

Analysis of the Magnetic Force Vectors during Operation



Kromrey's original design for the generator had a number of unique benefits when it came to providing electric current without drag. Some of these features are illustrated in the image to the right, where we are looking at the generator in a side view.

In Position A, we can see the rotor is aligned with the stator magnet, and is therefore magnetized to its maximum degree. The dot in the middle of the rotor piece represents the axle around which the rotor will pivot and the little **Red Arrow** indicates the direction of rotation.

In Position B, the rotor has moved out of alignment with the stator magnet as it rotates in a clockwise direction. The **GREEN ARROW** represents the attraction force between the stator magnet and the rotor iron, which in this case is in opposition to the direction of rotation.

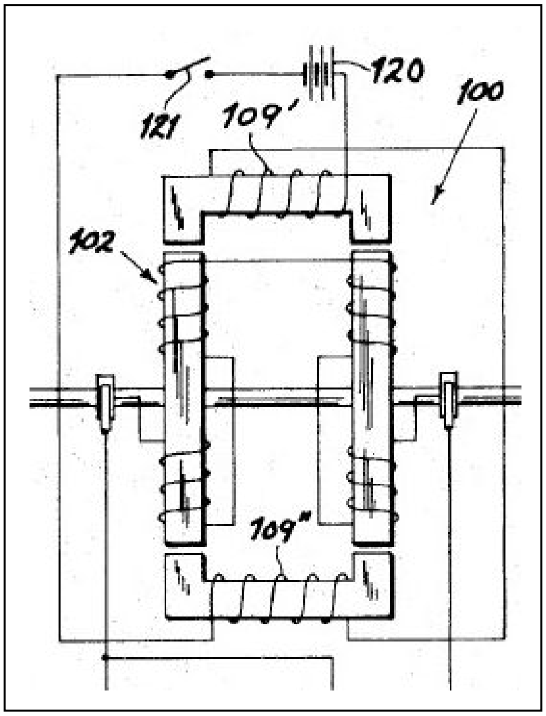
However, as the rotor proceeds from Position B around to Position D, the rotor is far enough away from the stator that no external magnetic forces can attract it in either direction.

During this period, the iron in the rotor is trying to de-magnetize and the Lenz Law reaction of the load current is trying to retard that change in magnetic flux. Upon careful examination, it becomes obvious that the lower the impedance of the load, the higher the current production on the rotor, the slower the magnetic field decays and the longer the magnetic field persists, all the while producing no interaction with the stator.

Herein lies one of the reasons Kromrey called this the "Ferromagnetic Generator." The more iron the rotor piece had in it, the longer the magnetic field could persist while producing current into low impedance loads. It also meant that the rotor didn't need to be re-magnetized as often to continue to produce current, essentially allowing it to produce full power at lower speeds, which is exactly what Kromrey reported.

Kromrey stated that a short circuit load completely neutralized the magnetic attraction as the rotor left the alignment Position A, so that the **GREEN ARROW** shown at Position B above didn't even appear!

And there is one more interesting feature. You may recall the discussion in the **SG Intermediate Handbook** where the Inertial Properties of electricity are discussed. Here, in the Kromrey generator, the rotor arms and the output coils are subjected to a very significant centrifugal force during operation and the winding of these coils is apparently designed to take advantage of this.



Here is a close-up taken from Figure 6, also seen on page 67. Notice how the four sections of the rotor coils are wound and how they are connected together.

Highlights from Kromrey's Report

Before his death, Raymond Kromrey produced a 15 page report titled the **Operating Principles of the Ferromagnetic Generator**, a complete copy of which is included in the Appendix section of this book.

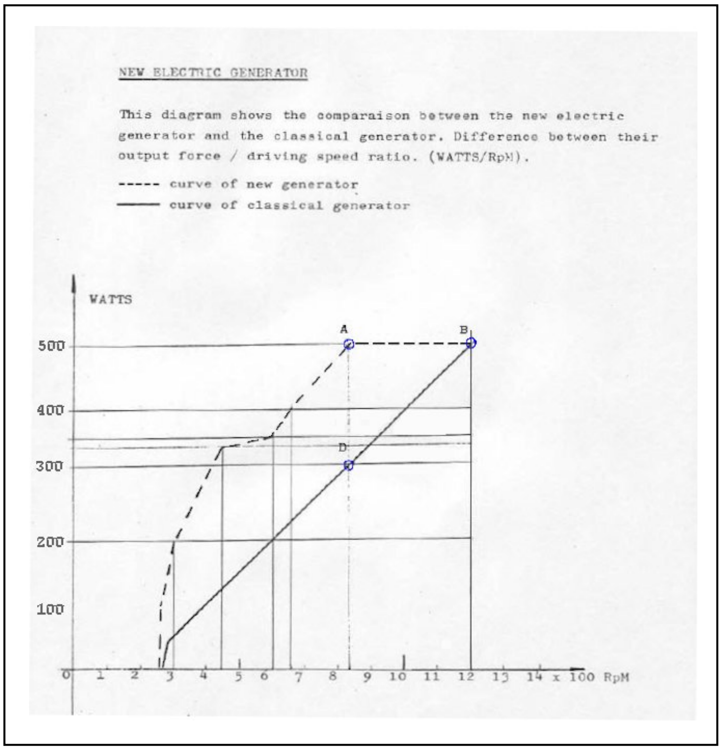
In it he discusses his theories about how the generator worked and where the excess energy was coming from. But most importantly, he publishes some test data and summarizes its performance

Here is a list of some of the claims:

- Transforms the acceleration due to a permanent magnetic field into electrical energy
- Has negligible braking effect under short circuit conditions
- Able to produce maximum power into extremely low impedance loads without overheating
- Able to produce stable power levels over a wide range of speeds

This graph is from Kromrey's report. It illustrates the unusual, non-linear speed and power curve of the machine.

It shows that the new electric generator was able to produce 330 watts at about 450 rpm, were the classical generator could only produce about 120 watts. It also shows the new generator reached maximum output of 500 watts at about 830 rpm and continued to produce 500 watts all the way up to about 1200 rpm (and beyond).



NEW ELECTRIC GENERATOR

This diagram shows the comparaison between the new electric generator and the classical generator. Difference between their output force / driving speed ratio. (WATTS/RpM).

Summary

Clearly, Kromrey's Generator was able to produce both electric current and power while either avoiding or re-directing the Lenz Law reactions against the stator. It's ability to produce electricity without mechanical drag was discovered in the 1960s and re-verified by John Bedini in the early 1980s.

But the machine was really loud when running, and it required the complication of sliding contacts to get the power out. John was looking for something better. At minimum, he wanted a generator that had low drag, but also one that ran quietly, and didn't need brush contacts.

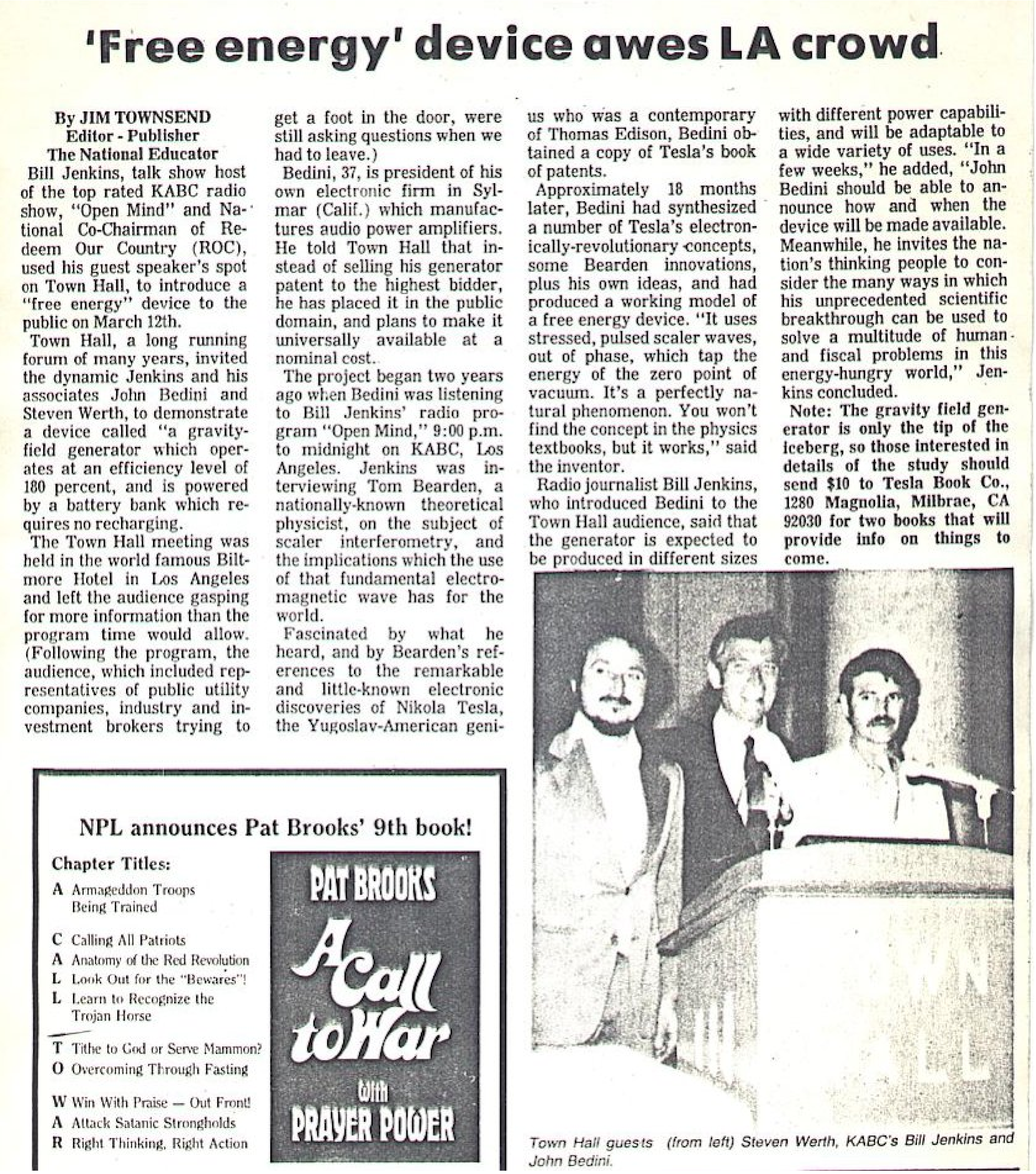
By June of 1984, when he published **Bedini's Free Energy Generator**, the Energizer design shown in the book accomplished all of these goals.

Oh Yes, and This....

The last little "detail" about the Kromrey Generator that has been generally overlooked is the fact that it produces a different "quality" of electricity than classical generators. This, of course, is not supposed to exist, but John documented this fact on countless occasions. During a demonstration of a large machine in Los Angeles to a group of VIP guests in a hotel conference room, John was able to light 3000 watts of light bulbs from the machine across insanely small, #30 gauge wire without any heating effects. The input electric motor was drawing 525 watts from a metered supply.

The phenomena was deemed "so incredible" that most of the engineers present simply started looking for the "real wires" buried under the carpet! Of course, there weren't any, but the demonstration was so far outside the classical "world view" of the electrical engineers, that no one believed what they saw, and all of the potential investors were dissuaded from getting involved.

Here's a brief article on that meeting:



'Free energy' device awes LA crowd

By JIM TOWNSEND
Editor - Publisher
The National Educator

Bill Jenkins, talk show host of the top rated KABC radio show, "Open Mind" and National Co-Chairman of Redeem Our Country (ROC), used his guest speaker's spot on Town Hall, to introduce a "free energy" device to the public on March 12th.

Town Hall, a long running forum of many years, invited the dynamic Jenkins and his associates John Bedini and Steven Werth, to demonstrate a device called "a gravity-field generator which operates at an efficiency level of 180 percent, and is powered by a battery bank which requires no recharging.

The Town Hall meeting was held in the world famous Biltmore Hotel in Los Angeles and left the audience gasping for more information than the program time would allow. (Following the program, the audience, which included representatives of public utility companies, industry and investment brokers trying to get a foot in the door, were still asking questions when we had to leave.)

Bedini, 37, is president of his own electronic firm in Sylmar (Calif.) which manufactures audio power amplifiers. He told Town Hall that instead of selling his generator patent to the highest bidder, he has placed it in the public domain, and plans to make it universally available at a nominal cost.

The project began two years ago when Bedini was listening to Bill Jenkins' radio program "Open Mind," 9:00 p.m. to midnight on KABC, Los Angeles. Jenkins was interviewing Tom Bearden, a nationally-known theoretical physicist, on the subject of scaler interferometry, and the implications which the use of that fundamental electromagnetic wave has for the world.

Fascinated by what he heard, and by Bearden's references to the remarkable and little-known electronic discoveries of Nikola Tesla, the Yugoslav-American genius who was a contemporary of Thomas Edison, Bedini obtained a copy of Tesla's book of patents.

Approximately 18 months later, Bedini had synthesized a number of Tesla's electronically-revolutionary concepts, some Bearden innovations, plus his own ideas, and had produced a working model of a free energy device. "It uses stressed, pulsed scaler waves, out of phase, which tap the energy of the zero point of vacuum. It's a perfectly natural phenomenon. You won't find the concept in the physics textbooks, but it works," said the inventor.

Radio journalist Bill Jenkins, who introduced Bedini to the Town Hall audience, said that the generator is expected to be produced in different sizes with different power capabilities, and will be adaptable to a wide variety of uses. "In a few weeks," he added, "John Bedini should be able to announce how and when the device will be made available. Meanwhile, he invites the nation's thinking people to consider the many ways in which his unprecedented scientific breakthrough can be used to solve a multitude of human and fiscal problems in this energy-hungry world," Jenkins concluded.

Note: The gravity field generator is only the tip of the iceberg, so those interested in details of the study should send $10 to Tesla Book Co., 1280 Magnolia, Milbrae, CA 92030 for two books that will provide info on things to come.

Town Hall guests (from left) Steven Werth, KABC's Bill Jenkins and John Bedini.

NPL announces Pat Brooks' 9th book!

Chapter Titles:

A Armageddon Troops Being Trained
C Calling All Patriots
A Anatomy of the Red Revolution
L Look Out for the "Bewares"!
L Learn to Recognize the Trojan Horse
T Tithe to God or Serve Mammon?
O Overcoming Through Fasting
W Win With Praise — Out Front!
A Attack Satanic Strongholds
R Right Thinking, Right Action

PAT BROOKS
A Call to War
with
PRAYER POWER

Chapter Nine

Other Advances, Old and New

The whole time all of this was happening, John and his brother Gary were running Bedini Electronics, Inc., an electronic manufacturing company building and selling high fidelity audio amplifiers, designed by John. This put him in contact with a wide variety of other electrical engineers and electronic circuit designers living in the Los Angeles area, and elsewhere.

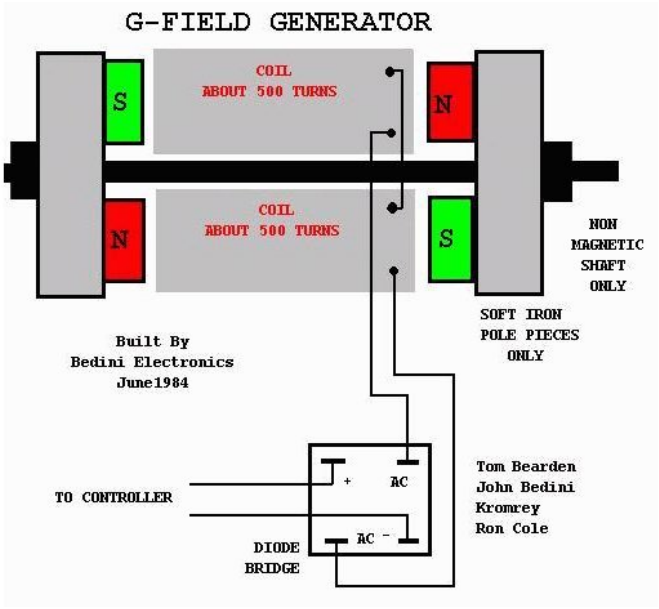
One such colleague was a brilliant engineer named Ron Cole. Ron worked for the local NBC television station in Los Angeles (KNBC) and was an exceptional inventor and model builder in his own right. Ron was the person who introduced John to Ed Gray back in 1974. As they got to know each other better, they found they had many of the same interests, and in later years, they would work together on projects into the wee hours of the night.

Early on, both Ron and John knew that Ed Gray's motor was able to run, produce significant mechanical energy, and keep its batteries charged all at the same time. But Gray's system was impossibly complicated and needed very high voltages to accomplish its feats. This set them both out on a quest to find a "simpler way" to accomplish the same end result.

The discovery and experimentation with the Kromrey Generator convinced them that there was a "low voltage" path to understanding the self-running electro-mechanical machine. After this was established, it was just a matter of running enough experiments to find the best way.

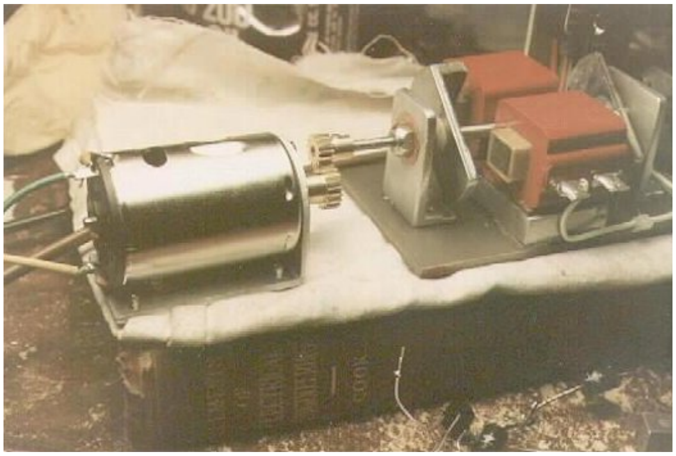
But Ron worked for a big corporation, and could not afford to be openly associated with a radical technology like this. So for the most part, he worked with John privately, and it was a very creative collaboration.

G-field Morphs into the G-flux Configuration



One of the first drawings to show up with Ron Cole's name on it is this image. John has been putting Tom Bearden's name on these drawings to honor his work in testing the designs and offering theoretical ideas, but Tom really didn't help John design any of these devices.

This was the first variation of the "G-field Generator" where they tried to get away from the sliding contacts and put the coils in the stator again. This image is dated June, 1984, which is exactly when John published his book. But this design was not in the book.



Here we see one of the early models of this configuration, built by Ron Cole at his shop. Test results on this type of machine were very good, and demonstrated many of the same performance benefits that Kromrey's design did.

With one exception. This generator showed the standard "reverse drag profile" of most other switched reluctance generators. That is, it shows maximum drag under "open circuit" conditions and minimum drag under "short circuit" conditions, where the "sweet spot" is a very low impedance load.

Here is the data from one set of tests on this machine.

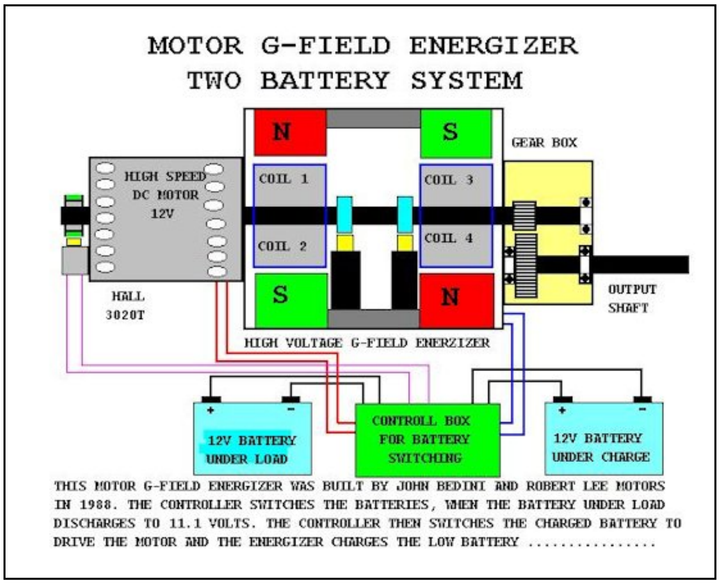
Test 1: **No Load (open circuit)**
Input Power 25.4 Volts at 3.90 Amps= 99.00 Watts
Output Power 48 volts
Test 2: **Load = 37.33 Ohms**
Input Power 25.3 Volts at 3.90 Amps= 98.67 Watts
Output Power 28 Volts .75 Amps= 21 Watts
Test 3: **Load = 13.50 Ohms**
Input Power 20 Volts at 3.39 Amps= 67.80 Watts
Output Power 50 Volts at 3.70 Amps= 185.19 Watts
Test 4: **Load = 0.63 Ohms**
Input Power 21.9 Volts at 2.30 Amps= 50.37 Watts
Output Power 20 Volts at 31.75 Amps= 634.92 Watts

These test results have been posted on John's website since 1996 and have been generally ignored. This is understandable, since they do not specify the speed of the generator during the various test results or the specific output circuit showing a rectified output driving a resistive load.

But there is other evidence that this design behaved with extremely low drag under low impedance loading conditions, including battery charging.

Two Battery Systems

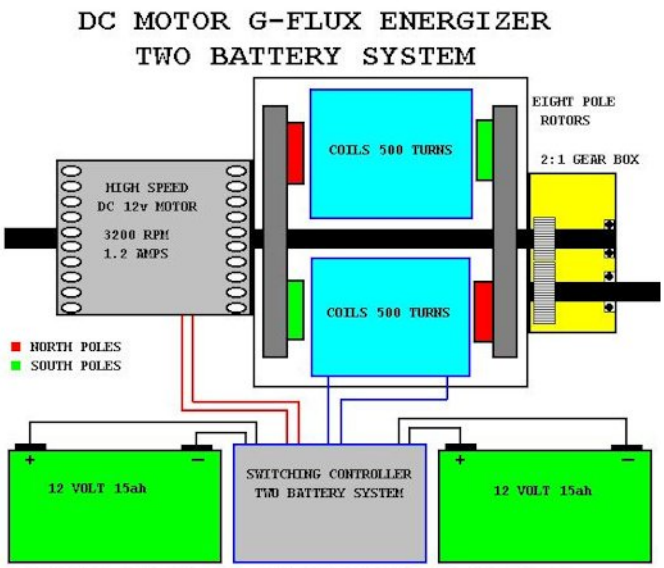
This image, dated 1988, shows a Kromrey style generator charging a second battery while the drive motor is run from the first battery. The excess mechanical energy is then geared down for use by an external mechanical load.


MOTOR G-FIELD ENERGIZER
TWO BATTERY SYSTEM

THIS MOTOR G-FIELD ENERGIZER WAS BUILT BY JOHN BEDINI AND ROBERT LEE MOTORS IN 1988. THE CONTROLLER SWITCHES THE BATTERIES, WHEN THE BATTERY UNDER LOAD DISCHARGES TO 11.1 VOLTS. THE CONTROLLER THEN SWITCHES THE CHARGED BATTERY TO DRIVE THE MOTOR AND THE ENERGIZER CHARGES THE LOW BATTERY ....

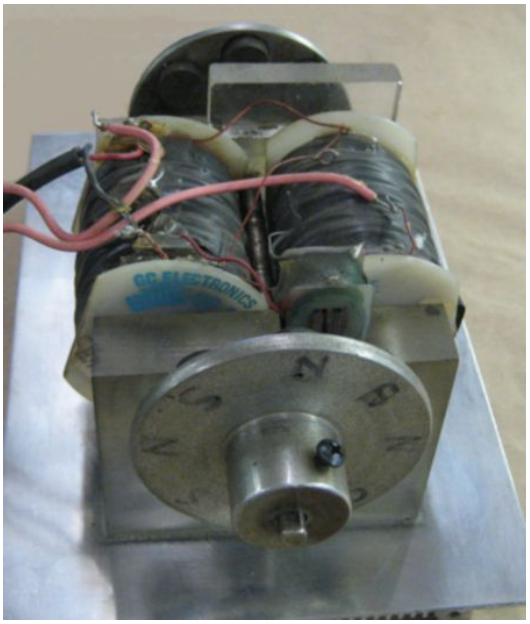
The green control box includes circuitry that monitors the battery voltages and automatically switches the batteries when the run battery drops to 11.1 volts.

In this image, dated 1989, we see that this configuration is now being referred to as the "G-flux Energizer." The caption in this image also says that this design was being developed to power an electric boat with the excess mechanical energy used for propulsion and the Energizer used to provide extended run times on the battery system.



DC MOTOR G-FIELD ENERGIZER BUILT BY JOHN BEDINI AND ROBERT LEE MOTORS JULY 1989. THIS POWERED A 10 FOOT BOAT, THIS WAS THE LAST UNIT TO BE BUILT BY ROBERT LEE MOTORS. THE CIRCUIT WORKS THE SAME AS THE TOP PICTURE ONLY THE BATTERIES ARE LARGER.

So, by 1989, we see significant improvements to the Self-running Energizer circuit disclosed in the 1984 book which only used one battery. The drawing above shows a two pole rotor but specifically stipulates an eight pole rotor. This arrangement was tested on a wide variety of systems over the years, such as in this model.

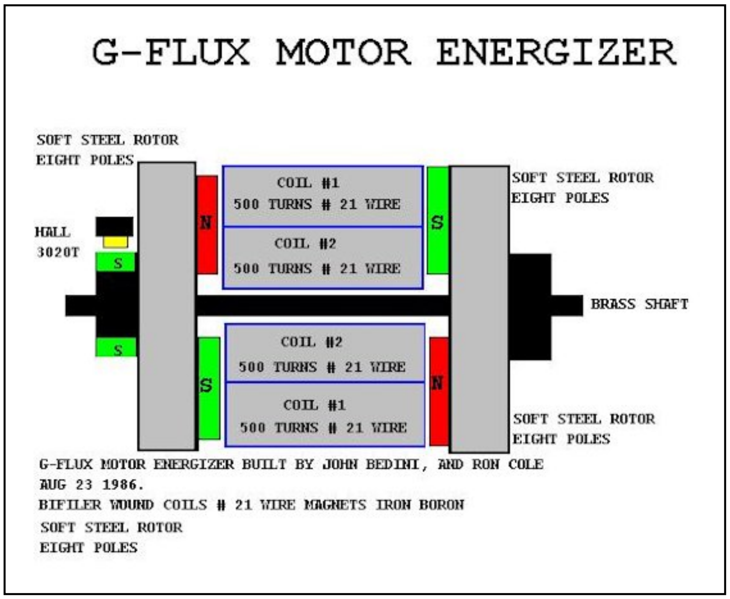


Switching Circuits and Motor Control

While John was focusing on simplification, and the single-sided, self-triggered circuit that evolved into the SG circuit we know today, Ron was interested in using these configurations to produce more mechanical energy, like a standard electric motors does.

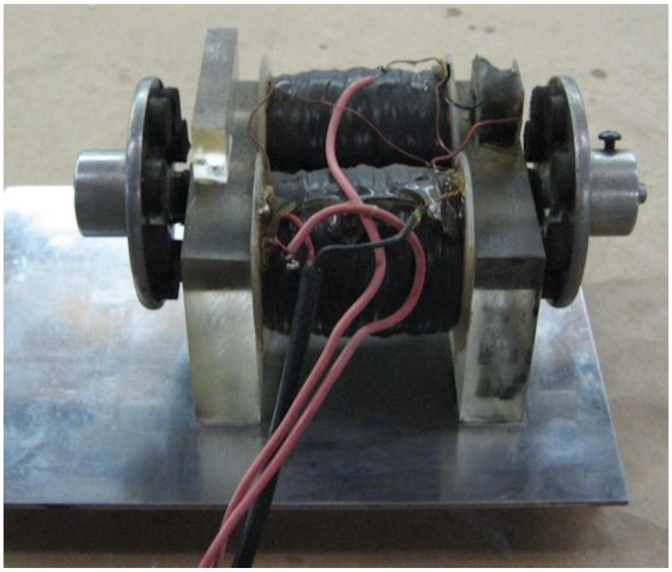
For this type of operation, Ron needed a double-sided switching circuit, so the coils could be energized and then completely disconnected from the supply before being reconnected in the opposite polarity.

Here is an example of one of the compound, self-rotating Energizer designs from this period. It is designed to both motor and generate, but has both North and South magnetic poles, so the double-sided switching circuits were required. This image is dated Aug 23, 1986.

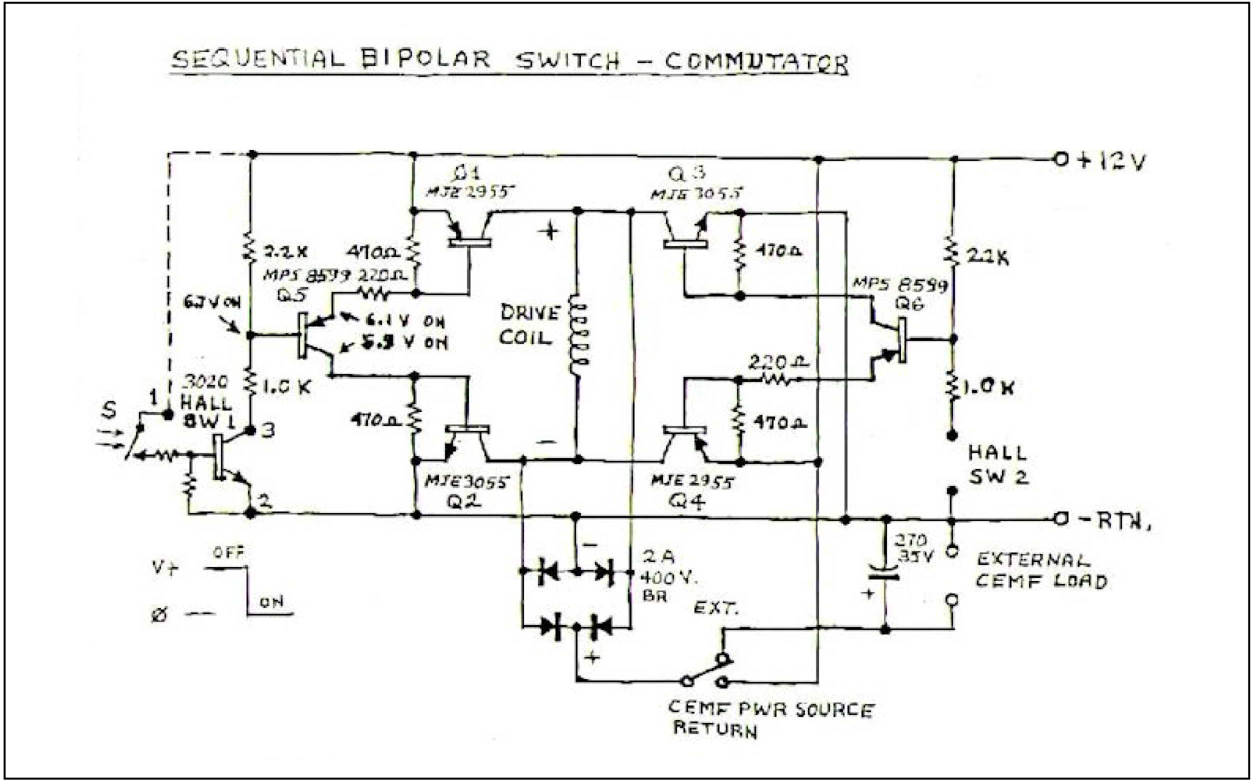


It also stipulates eight poles on the rotor, as well as a "hall effect" device on the left end of the shaft, with its own small magnets, to control the motor timing.

This image shows a model of this topology built by John in about 1983. It used early NEO magnets, listed as "iron boron" magnets in the drawing, and fairly wide air-gaps between the rotors and the coils. It had both motor and generator coils on the same cores in the stators. Unlike the drawing, this model had a separate "trigger coil" mounted in the upper right hand corner, shown with the very fine magnet wire coming out of it.



Here is the circuit used for the motor drive section of this type of combined motor-energizer which used both magnetic poles on both sides of the rotor.

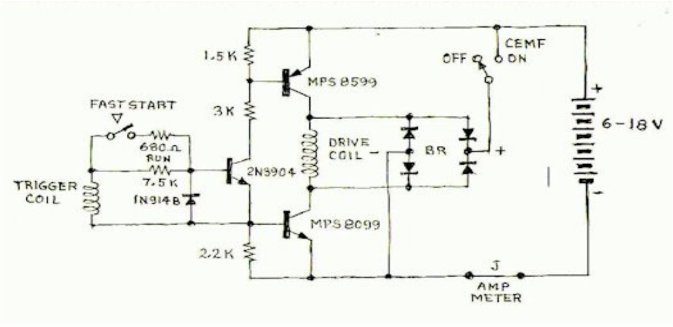


This circuit shows only a single battery supply with the inductive recovery collected through a full-wave bridge rectifier and stored on a capacitor, which is then optionally offered to an external load or back to the primary supply. The point of the circuit was not to define all of the recovery options, but to clearly define the drive coil design for a bi-polar configuration with full disconnect and full reversal of the coils during operation. The Bedini "Window Motors" used this circuit, as well.

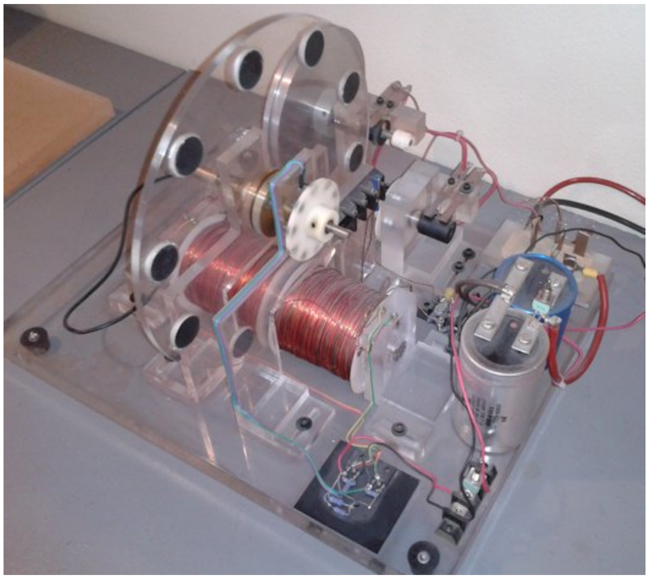
Mind you, electronic commutation of this type was not used in commercial motors for another 20 years, so this was very sophisticated stuff for 1986.

Ron and John also developed a single-sided drive circuit that John has used in various models of his "Monopole" motors since this time.

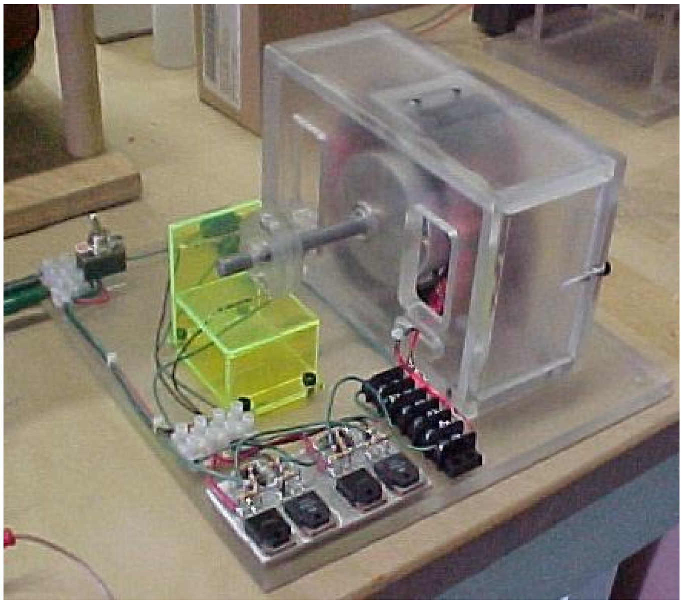
Here is a variation of the "Bedini-Cole Switch" that is triggered by a "trigger coil" like the SG, but it could also be triggered by a Hall Effect device like the circuit on the previous image.



In this image, we see a classic twin coil design, set to run in the "forced repulsion mode" using the single sided Bedini-Cole switch, seen mounted on the black plate in the lower right. The Hall Effect device is triggered by a second set of smaller magnets mounted in the small white wheel on the shaft.



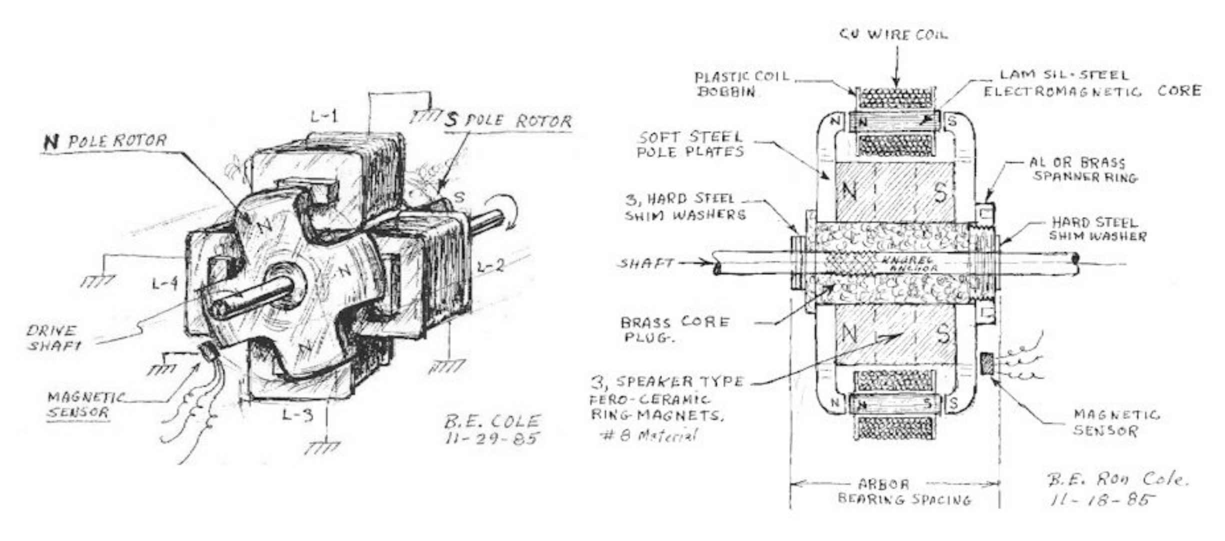
And here is another version of the double-sided switch triggered by magnetic reeds. This "Neutral Line Motor" designed by John and built in 2003 could reach 11,000 rpm.



The point is, this was all R&D, and dozens of variations were tried and found to have merit. The circuits that John has had on his website are just a "sample" of the many circuits that were built and tested.

Monopole Version of the G-flux Motor Energizer

One of the most interesting designs developed by Ron Cole during this period was this Monopole configuration, using ceramic ring magnets and iron pole pieces on the rotor. The design was extremely compact and it allowed high flux densities in the coil cores from low flux density ceramic magnets. It was also universal in its application, working equally well as a high torque motor with inductive recovery or as a low drag energizer powering low impedance loads, or both. It could operate as a repulsion motor using the Bi-Polar Switch or as an attraction motor with single sided switching, like an SG. This one configuration could do it all.



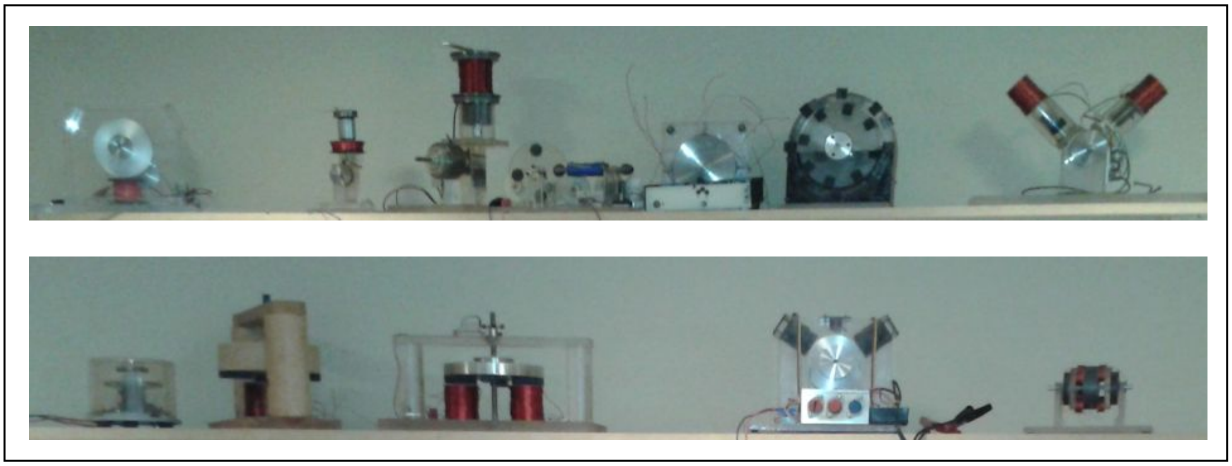
And this shows another talent that Ron Cole had, besides being a brilliant circuit designer and engineer. He was also a gifted illustrator.

It should be fairly clear by now that this technology was developed to a very high level through the 1980s, but because of the threats John received in 1984, they were very careful about who they let know. When Ron Cole died, all of his working models and files were confiscated by NBC because his contract stated that anything he developed during his period of employment belonged to them.

The Period of Quiet (1989 - 2004)

John moved to Idaho in 1990 for reasons associated with his audio amplifier business, and to be closer to his father, who lived in Coeur d'Alene. At this point, he had all but given up on ever trying to bring this technology out as a product. At the same time, he decided to start building small models of many of the variations of the systems that had been developed in the 1980s.

This is the period where John perfected the simple little circuit that can allow a toy motor to run an intolerably long time on a single 9 volt battery. Dozens of models were made with this circuit using both plastic and wood. Here is but a small sample of the working models in John's Museum!

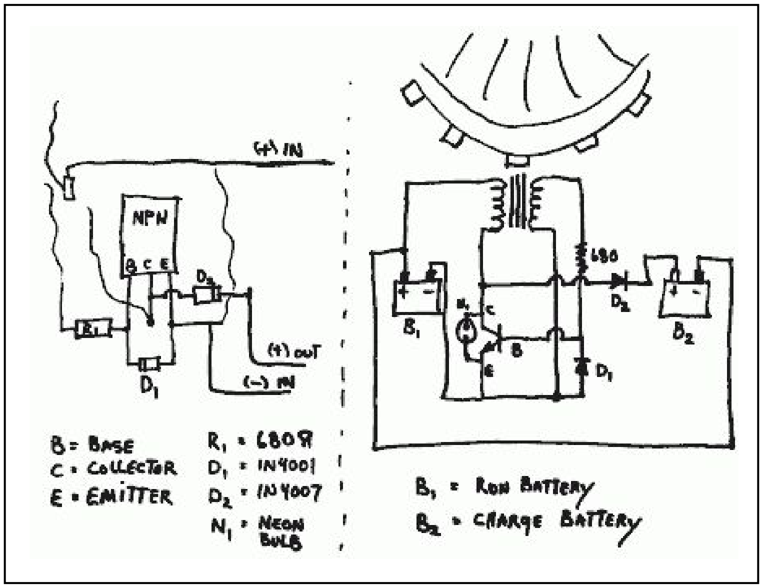


Shawnee Baughman built her Science Fair project motor during the 1999-2000 school year and John had the plans for that circuit posted on the Keelynet website by March of 2000. All of the electrical engineers and supposed "smart guys" who frequented the site dismissed the plans as "meaningless." Since none of them bothered to build a model, it was a classic case of "condemnation without investigation."

John had 20 years of working models in his shop! He simply could not understand why no one was willing to even look at this technology.

The SG Project Takes Off (2004)

In the summer of 2004, Sterling Allan visited John's shop. He was shown everything that was there. Since Sterling wanted to be the one who broke the "Free Energy" story to the world, he asked John if he could publish a set of plans and a parts list, so people could build one themselves. Since John had already done that with Keelynet, he agreed to issue an up-dated set of plans for Sterling.



Here is an image of the schematic and parts list given to Sterling for the "one transistor" circuit in September of 2004.

This new set of plans had two differences over the Keelynet circuit. First, he called it the "School Girl Motor" to purposely insult all of the supposed smart guys who had not looked at it before, and second, he used the two battery system where the motor ran from one battery and charged the second battery directly from the recovered energy.

Sterling also started a discussion forum on Yahoo Groups so people building the project could communicate with each other.

Sterling even built a model which worked quite well for a first attempt, being able to recharge the second battery at about 90% of the rate of the discharge of the first battery.

In spite of this, Sterling eventually declared that the technology was a "hoax" and that it was not a free energy machine since it did not run indefinitely without the batteries going down.

But the "cat was out of the bag" so to speak, and people from all around the world started reporting good results and wanting to learn more. By 2005, the discussion threads were turned over to Rick Friedrich to moderate, eventually being turned over to John in 2011.

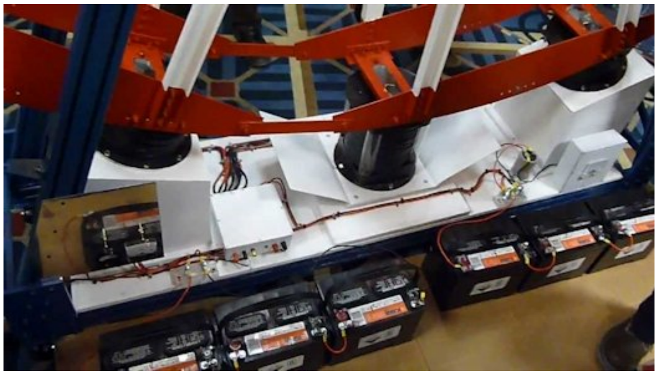
The discussion threads were a major advancement over the earlier period of "no publicity," but they produced a lot of confusion, because so many people were posting on how they thought the circuits worked. Finally, the effort was made to explain John's discoveries in a definitive series called the **Bedini SG Handbook Series**, of which this is the last volume.

The Bedini Ferris Wheel (2010)

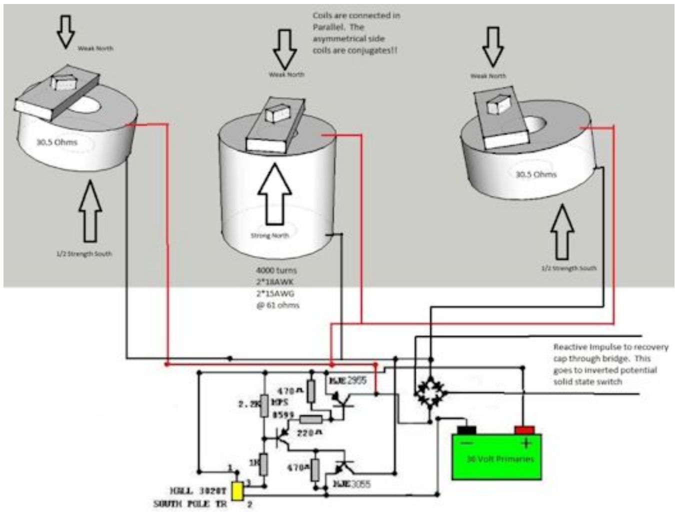
From August 1984 until November 2010, the "Jim Watson Machine" had been the largest model of John's technology ever shown in public. That changed on November 13th, 2010, when John unveiled his "Ferris Wheel" machine to an audience of over 400 attendees at the first Bedini Technology conference in Coeur d'Alene, Idaho. This picture was taken by one of the participants from the back of the room. The 14 foot diameter "Ferris Wheel" machine can be seen in the distance.

Courtesy of sandysanfords.wordpress.com

The machine took over two months to build and cost over $20,000. It was designed to demonstrate John's technology to the crowd in a dramatic manner. Beyond that, it has had a relatively prosaic life. It was shown again at the 2011 conference, after which, it has never been fully assembled. The problem was that when fully assembled, the machine was 6 inches taller than the large bay doors at John's shop. It was a lot of work to rebuild the top section of the wheel and since no more tests were run on it, it was never reassembled. It stayed partially disassembled at John's shop through 2012, and was finally moved into storage when John down-sized his shop in 2013. It remains partially disassembled, but potentially operational today.



The machine had three large coils of wire on the bottom and was operated in "full power mode" with the bi-polar "Bedini-Cole Switch" like the one shown on page 82. The only difference was that the components in the switch were modified to operate a very low impedance circuit. The input was 36 volts (three 12 volt batteries in series) and the output was the same. The batteries boiled continuously during operation, and John never ran it for more than 30 minutes at a time in full power mode. The batteries were too small to be charged that hard.



Although John has not revealed the entire schematic for the Ferris Wheel machine, there is quite a bit of data on the internet. Here is one drawing that is posted on a discussion thread dedicated to this machine. It shows how the magnets on the wheel interface with the three coils, and the control circuit being basically a "Bedini-Cole Switch." The machine also had a two foot diameter "hub motor" section that operated as a motor during the "idle mode" and as a generator in "full power mode." The circuitry used here was also a modified Bedini-Cole Switch with recovery to the charge battery system.

For more information on the technical details of the Ferris Wheel machine, go here: http://www.energeticforum.com/john-bedini/6786-bedini-ferris-wheel-regauging-motor.html

One Battery, Two Batteries, Three Batteries, Four...

This book would not be complete without mentioning the significance of the role of the battery in all of John's systems. To date, John has built and demonstrated machines and circuits that "self-run" using one battery, two batteries, three batteries, and four batteries. All of the systems he has demonstrated have at least one battery. The battery is a central component in all of John's work.

In John's 1984 book **Bedini's Free Energy Generator**, he shows the method of building a self-running machine using one battery. This process draws energy from the battery to drive an ordinary (direct induction) DC motor to produce mechanical energy. This mechanical energy is used to sustain the rotation of a flywheel (stored momentum) and an Energizer (low drag generator) that is used to charge a capacitor (stored electrical charge) while dissipating very little of the mechanical energy.

Ordinary DC traction motors of this type use their internally generated "back EMF" to limit the current consumed by the motor in direct relationship to the speed. This means that the faster it turns, the less current it draws. So, the system works better as the motor approaches its "top speed." Speed also favors the Energizer, since it will produce more "peak voltage events" per second to charge the capacitor, the faster it goes.

The "sweet spot" for this machine is a very low friction mechanism! Mechanically, it must be perfectly aligned and fitted with free-running bearings so that it is capable of reaching its highest possible speed for the lowest expenditure of mechanical force. As the speed rises, the motor draws less and less electrical energy from the battery, while the Energizer is able to put more and more back in from the capacitor discharges.

At a critical speed, the system starts putting more energy into the battery than it is taking out and it moves into "self-running" mode. The machine has three energy storage components in it. They are the Flywheel, the Capacitor, and the Battery.

During "self-running" mode, all three energy storage components reach maximum capacity. The Flywheel maintains maximum speed, whether the electric motor is running at the moment or not. The Capacitor is constantly charged by impulses from the Energizer in a way that removes almost no momentum from the Flywheel. At operational speed, the electric motor draws minimal electricity from the battery about 50% of the time while 100% of the output from the Energizer is either collected in the Capacitor or delivered directly back to the battery the other 50% of the time.

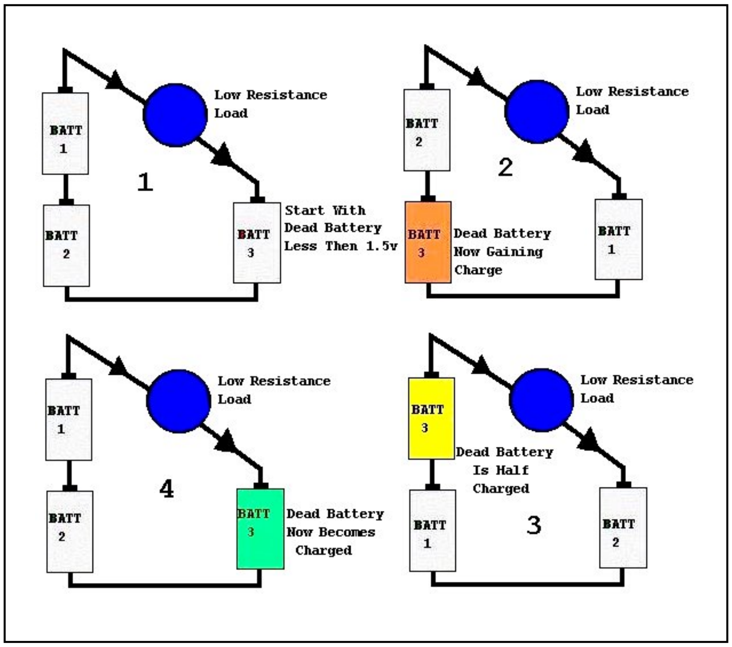
The battery is the primary energy reservoir of the system. It has the energy to start the system and get it up to operating speeds, and it has the capacity to absorb all of the excess energy produced by the system. To make a home power plant out of a system like this, just put more and more batteries in parallel with the first, and use a switching process that won't burn itself out. After that, just "let it run".... as John always says.

As straight forward as this seems, John found that most people could not make it work. For the most part, it wasn't their fault. The problem was the battery. The fact is, batteries do not like to be "charged and discharged" simultaneously or even sequentially, in rapid succession. It has to do with the energy required to constantly overcome the inertial momentum stored in moving the large lead ions back and forth in the electrolyte.

To get around this "inertial mass" loss mechanism at the molecular level, John developed his two battery systems, where one battery runs the machine and the other battery is charged for a number of hours, and then they are switched only once or twice a day. This worked much better, but still most people could not get it to work. Most of the reasons experimenters have gotten bad results with the two battery systems are covered in detail in the **Bedini SG Intermediate Handbook**.

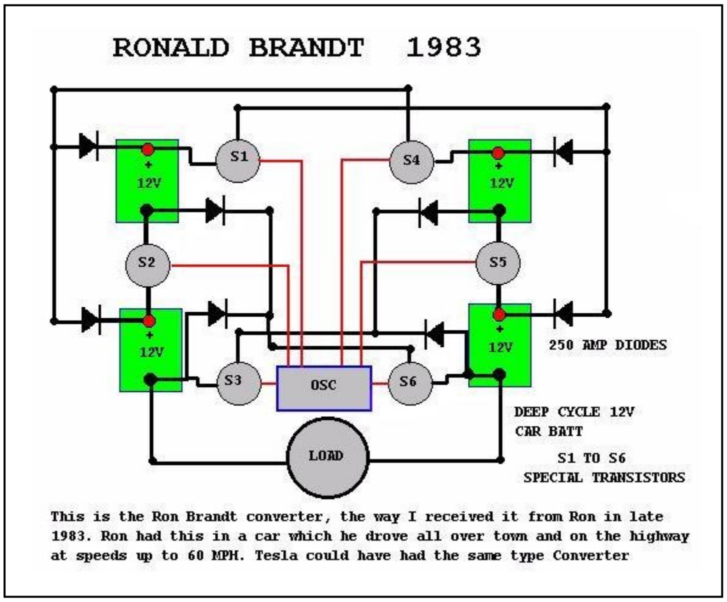
And this brings us to the consideration of the three battery systems. For the most part, the three battery system was presented as a method to explain why the four battery system worked. In the last few years, however, a couple of skilled experimenters have found that it has a number of specific merits, all by itself.

This diagram has been on John's website since 1996 and shows a method whereby a dead battery can be charged while running a "low resistance load", like an electric motor turning an Energizer, for example! This method allows an ordinary electric motor to operate while the current is conserved to charge a battery at the same time.



John shows that by rotating the batteries around to each of the positions, all of the batteries improve in their state of charge, all the while running the load. This is where most "self-respecting" scientists lose interest. As long as you believe in the "Law of Conservation of Energy," you will NOT consider investigating this phenomena. As long as you believe that the load "consumes" electricity, you will not investigate reports that it is being "conserved" at the same time as it is being used.

To learn more about these developments, check out this discussion thread with more than 300 posts: http://www.energeticforum.com/renewable-energy/10610-3-battery-generating-system.html



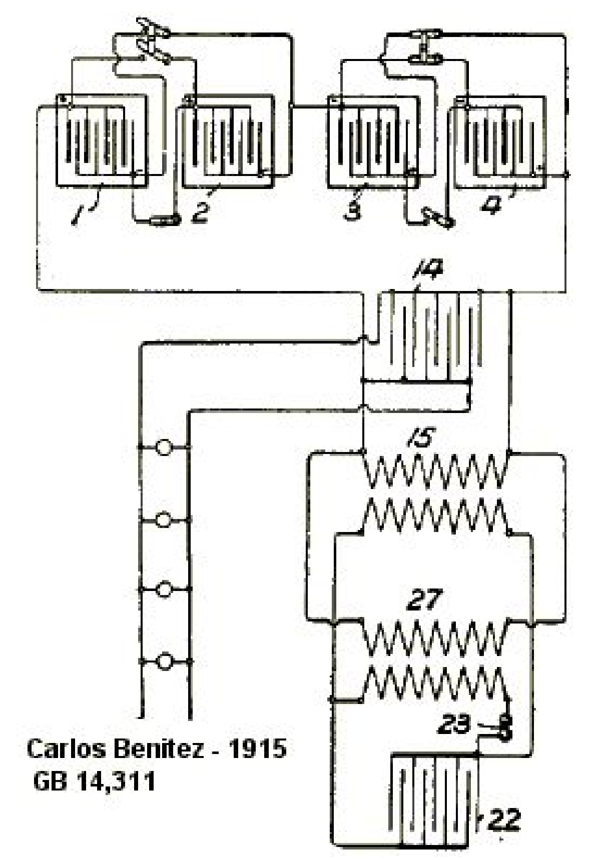
This is the Ron Brandt converter, the way I received it from Ron in late 1983. Ron had this in a car which he drove all over town and on the highway at speeds up to 60 MPH. Tesla could have had the same type Converter

But this gets even worse with the four battery systems! This drawing has been on John's website since 1996, and his work with circuits like this dates back to 1983. First introduced to these ideas by Ronald Brandt, this circuit topology John eventually named the "Tesla Switch."

The circuit shows a load being operated between the Negative Terminals of two batteries that are alternately connected in series and parallel with two other batteries, producing a fluctuation of current between two points of "equal" potential.

When switched abruptly between these two states, the load operates on a "cold form" of electricity without discharging the batteries. John was interested in this phenomena because it elicited the expression of the same kind of "modified electricity" that he so clearly demonstrated with his tests on the Kromrey Generator.

Historically, the circuit can be traced, not to Nikola Tesla, but to the 1915 Patent issued to Carlos F. Benitez, a Civil Engineer living in Guadalajara, Mexico.



Carlos Benitez - 1915
GB 14,311

Here is the primary image from that patent. It shows four batteries being connected sequentially in series or parallel, and loads being operated from the fluctuations of current between the Negative Terminals.

The Benitez Patent descriptions clearly disclose the method, but the patent does not mention the change in the "quality" of the electricity.

Ronald Brandt was the first to clearly state that the currents moving in this system had "unusual properties" and John Bedini is absolutely the first person in history to get a system like this operating with purely solid-state switching.

Here is a picture of John showing this first solid-state demonstrator at the 1984 Tesla Centennial Symposium.

Courtesy of Sky Fabin Productions

Whether Ronald Brandt rediscovered this method through experimentation, or somehow knew of the prior work of Benitez, is not known. What is known is that he introduced John to it.

Every system John has shown uses batteries. While at first glance, the one and two battery systems seem to be dependent on the low drag performance of the Energizer style of generator, this is NOT what John was interested in!!! John was interested in the various methods of eliciting the modified forms of electricity, and their effects on the batteries.

Once you grasp the significance of the "cold form" of electric currents that blatantly appear in both the Kromrey Generator and the "Four Battery Switch", the more easily you can comprehend why Tom Bearden theorized ideas of the "Phi-dot" current and the idea that "the battery charges itself." This is exactly what they were seeing!

In these early days, the experiments were running way ahead of the explanations. They were grasping to develop a language with which to describe these discoveries, and Tom Bearden was the only one who volunteered to rise to the challenge. But outside of the inner circle, where the evidence of these realities was firmly established, there was nearly unanimous rejection of these ideas!

[For more information on the "Four Battery Switch" method, take a look at this, and other discussion threads at the Energetic Forum: http://www.energeticforum.com/renewable-energy/5227-carlos-f-benitez.html]

Trade-off....#1

Here is what all of the experimental evidence suggests. Voltage and current are two separate and distinct aspects of "electricity." They can appear individually, or together. When voltage appears without current, the presentation is a "cold form" of electricity, most notably recognized as the spike produced by the discharge of an inductor into a high impedance load. This is the so-called "Radiant Energy" produced by the SG circuits.

When current appears without voltage, it too presents itself as a "cold form" of electricity, most notably recognized as the energy capable of running loads between the two negative terminals of the "Four Battery Switch."

Voltage without current is generated by the free-fall collapse of a magnetic field when the current is interrupted abruptly and the energy discharges into a high impedance load. Current without voltage is generated by the fluctuation of potentials in a low impedance circuit when the current is interrupted abruptly and the reflection of this fluctuation appears across a very low impedance load between two negative terminals.

Both of these forms of "cold electricity" flow through ordinary wires at room temperature with NO RESISTANCE. Ohm's Law does not describe their behavior within a circuit. Classical measurements on these modified forms of electricity are routinely inaccurate. Regardless of these measurement issues, these forms of electricity can and do perform real WORK in external circuits.

Only when voltage and current appear together do we have the standard presentation of electricity we have been incorrectly told is the "only one." So, normal "hot electricity" appears in the middle of the spectrum, where voltage and current appear together. By contrast, "cold electricity" effects appear at both ends of the spectrum, where either voltage or current appear without the other. If there is such a thing, THIS is one of the real secrets of free energy. Any circuit or machine that allows these conditions to manifest, will exhibit positive results in the real world that are difficult to quantify by measurement methods accepted by standard science!

Trade-off....#2

In the electro-mechanical machines, the appearance of these cold forms of electricity are directly related to the structures containing the magnetic fields. In the designs that close the magnetic fields down to closed loops, it is possible to produce more mechanical energy (stronger motoring effects) and what appears to be a higher "efficiency" generators, but the appearance of the modified forms of electricity is greatly reduced.

Conversely, when the magnetic fields are produced in structures that have large air-gaps in their return path, such as a coil of wire energized by a permanent magnet from only one end, a maximum of these modified forms of electricity are encouraged to show up, especially when combined with abrupt switching techniques. From a classical point of view, these structures are considered to be "very inefficient" and they exhibit a very low "power to weight" ratio, and are written off as if they are useless and archaic. From John's point of view, they are the simplest way to effectively gather this "cold form" of energy from the environment, or as Kromrey first said, from the gravitational field.

The Next Big Advancements

John is a prolific inventor, so there is no way to keep up with his creativity. At the 2014 Energy Science and Technology Conference, John unveiled his latest Linear Amplifier/Regulator circuits which can be used to shunt power from the charging battery back to the run battery without having to switch batteries. While he is not planning to publish that circuit anytime soon, you can purchase a model of this circuit at teslachargers.com

The next really big "advancement" has to come from thousands of people from all around the world who start to experiment with these technologies, learn the science, and build their own working systems. In 1984, this technology went "public" with the publication of John's book **Bedini's Free Energy Generator**. In 2004, this technology went "public" again, in the discussion forums. In 2014, it has to go public once more, this time with thousands of self-running models showing up all over the world.

Chapter Ten

Summary and Conclusion

At this point, the Bedini SG project has revealed at least a dozen designs of machines whereby John has already demonstrated, and you can learn to build, a system that produces enough energy to run itself and more.

These include the following:

1. An ordinary DC brush style motor turning a flywheel and a low drag generator running from and charging a single battery.
2. An ordinary DC brush style motor turning a flywheel and a low drag generator running from one battery and charging a second battery.
3. An ordinary DC brush style motor turning a flywheel and a low drag generator running from a three battery supply and charging an additional battery bank to power external loads.
4. An ordinary DC brush style motor running in pulse mode, with inductive recovery, turning a flywheel and a low drag generator running from one battery and charging a second battery system.
5. An ordinary DC brush style motor, running in pulse mode with inductive recovery, turning a flywheel and a low drag generator running from a three battery supply and charging an additional battery bank to power external loads.
6. A standard SG Energizer running from one battery and charging a second battery.
7. A standard SG Energizer running from a three battery supply charging an additional battery system.
8. A multi-coil SG Energizer turning an additional low drag generator running from a three battery supply and charging an additional battery bank to power external loads.
9. And many other variations!!!

In general, all of these systems fall into two main classes of machine. The first is the "motor/generator" combination, whereby the following performance characteristics are attained.

Electric Motors that:

1. are based on standard induction principles, but operate on minimal current due to "top speed" operation, reinforced by a flywheel.
2. are based on alternate motoring principles, using either attraction or repulsion, but use a pulse method so that an inductive collapse process allows some of the electricity to be recovered while mechanical energy is produced.

Electric Generators that:

1. are based on design principles that include coils wound on iron cores that are magnetized by moving magnets, and where the magnetic return path incorporates a large air-gap at least part of the time.
2. are based on design principles that allow Lenz's Law to neutralize or partly neutralize any reverse torques when low impedance loads are applied.

The second general class of machine are those that use battery configurations and/or abrupt switching methods to elicit "cold electricity" characteristics, which when applied back to the batteries, increase the charging efficiency by 200-to-300%. When a number of these principles are used together, COPs > 2 become increasingly easy to attain.

In spite of developing both methods, John was always more interested in the cold electricity effects, as the gains were always higher.

Nothing Guaranteed

Everything reported in this book series is true and factual. But that does not guarantee that "anybody" can duplicate these results. Each of these phenomena live in a narrow "window of opportunity" that the machine either captures or not, depending on the precision of its application.

To get a machine like this working requires:

1. a significant knowledge and understanding of the science
2. a general knowledge of math and engineering protocols
3. a minimum skill level of precision model building

If you do not understand the science, if you do not understand the mathematics that underpins electrical engineering, or if you do not have the requisite model building tools and skills, then it is not reasonable for you to believe that you can build one of these machines, beyond the model described in the **Beginner's Handbook**.

This technology is not an article of commerce yet. Right now, it only exists at the cutting edge of human understanding. The world's economic model is going to experience a difficult period of adjustment as this technology becomes more widely accepted. But that process is beginning right now.

Conclusion

This completes the **Bedini SG Handbook Series**. It completes the reporting and analysis of John's work to date, November 2, 2014.

It has taken two and a half years to write these three books. Thank you for your patience and for your interest in this material. It has been an honor and a privilege to work with John over the last 10 years, and to help you understand his life's work.

Appendices

Appendix #1

US Patent #3,374,376 Issued to Raymond Kromrey Page 100
Title: Electric Generator

Appendix #2

Operating Principles of the Ferromagnetic Generator Page 109
Written by Raymond Kromrey

Appendix #3

GB Patent #14,311 Issued to Carlos F. Benitez Page 125
Title: System for the Generation of Electric Currents

Appendix #4

Report on Visit to John Bedini (September 3, 1984) Page 135
Written by Eike Mueller

Other Resources:

A&P Electronic Media
Home of the Best Collection of Information Products
on the Planet! http://www.emediapress.com

Tesla Chargers
Home of "ready to use" battery chargers
designed by John Bedini http://teslachargers.com

Appendix #1

United States Patent #3,374,376

Electric Generator

Issued to Raymond Kromrey

March 19, 1968 R. KROMREY **3,374,376**

ELECTRIC GENERATOR

Filed Jan. 3, 1964 5 Sheets-Sheet 1

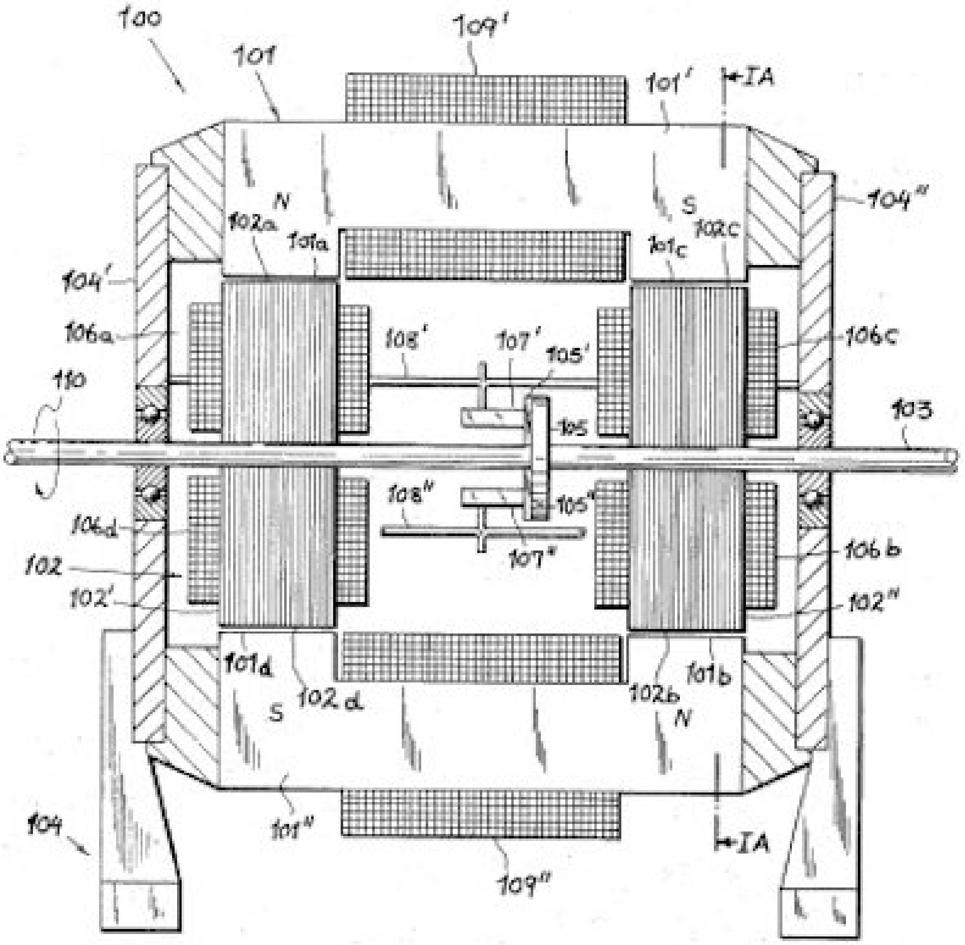


Fig.1

RAYMOND KROMREY
INVENTOR.

BY

Karl G. Ross

AGENT

March 19, 1968 R. KROMREY 3,374,376

ELECTRIC GENERATOR

Filed Jan. 9, 1964 5 Sheets-Sheet 2

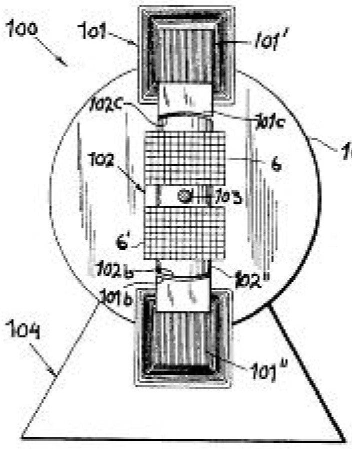


Fig.1A

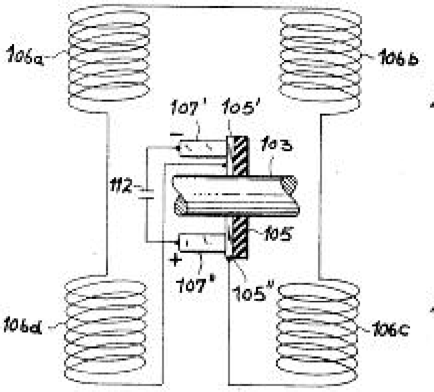


Fig.4

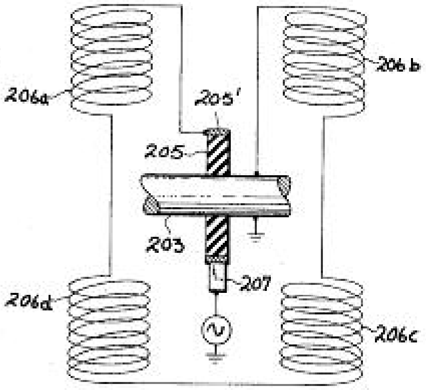


Fig.5

INVENTOR.
RAYMOND KROMREY

BY

Karl G. Ross
AGENT

March 19, 1968 R. KROMREY **3,374,376**

ELECTRIC GENERATOR

Filed Jan. 9, 1964 5 Sheets-Sheet 3

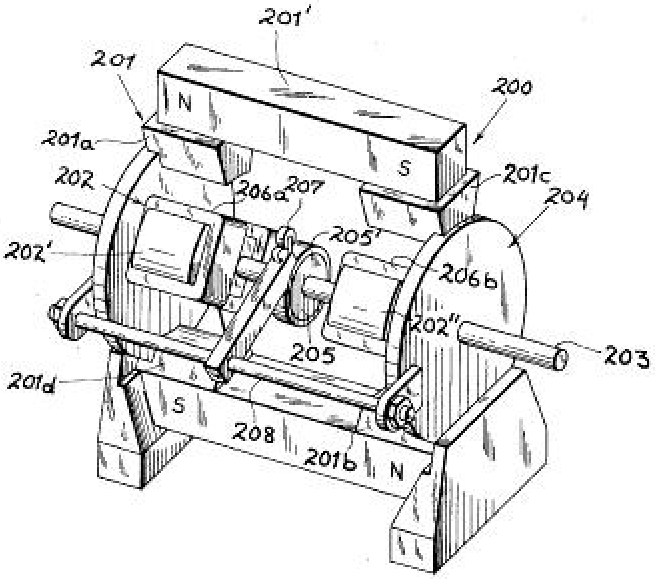


Fig.2

RAYMOND KROMREY
INVENTOR.

BY Karl G. Ross
AGENT

March 19, 1968 R. KROMREY 3,374,376

ELECTRIC GENERATOR

Filed Jan. 3, 1964 5 Sheets-Sheet 4

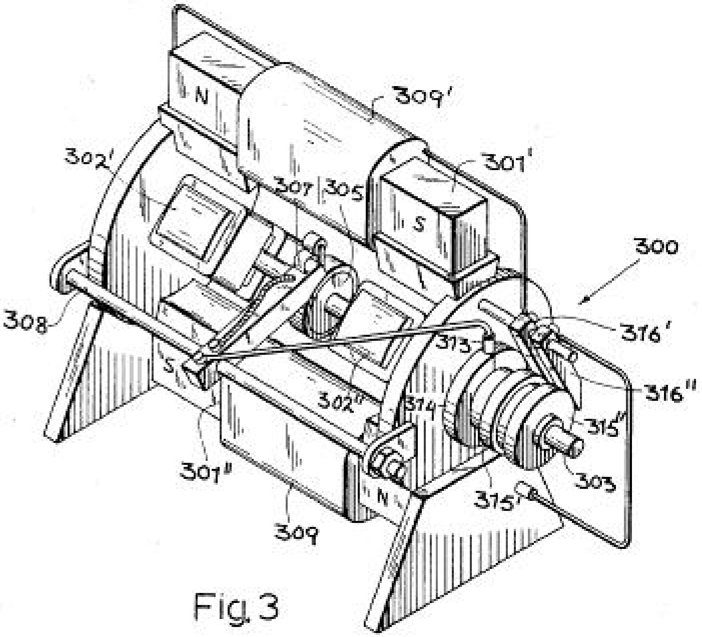


Fig. 3

RAYMOND KROMREY
INVENTOR.

BY Karl G. Ross
AGENT

March 19, 1968 R. KROMREY 3,374,376

ELECTRIC GENERATOR

Filed Jan. 3, 1964 5 Sheets-Sheet 5

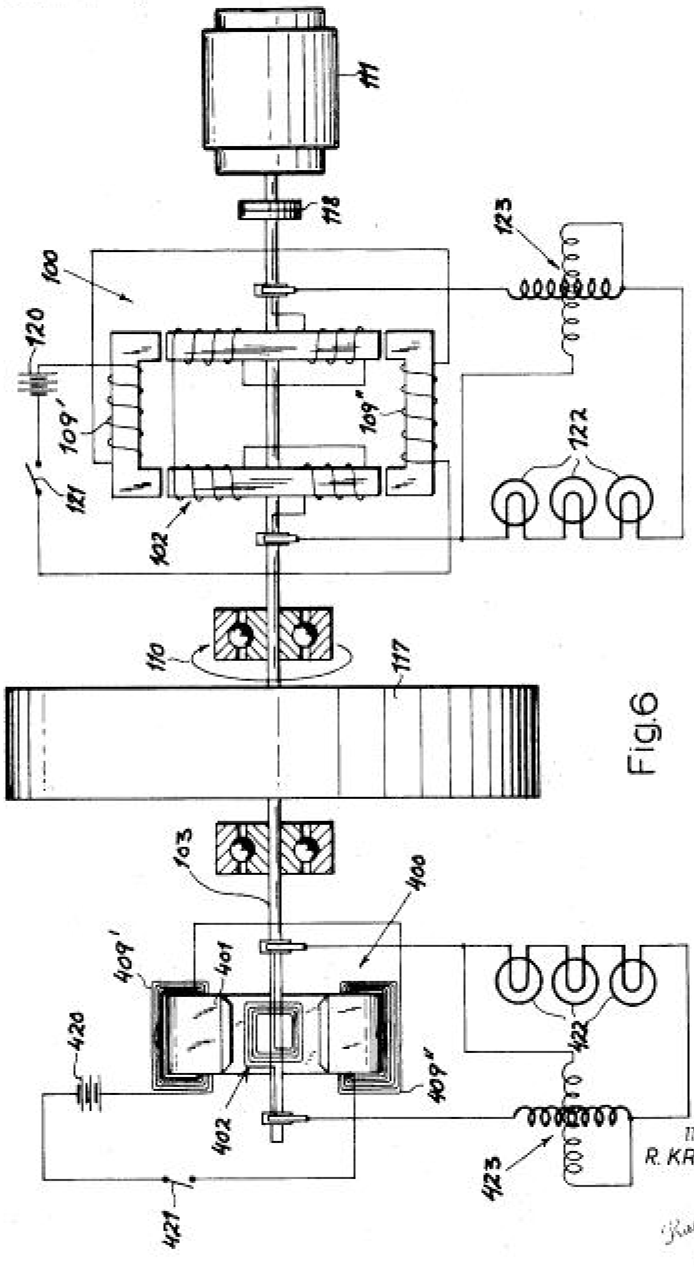


Fig.6

INVENTOR.
R. KROMREY

Karl F. Ross

AGENT

United States Patent Office

3,374,376
Patented Mar. 19, 1968

3,374,376
ELECTRIC GENERATOR
Raymond Kromrey, 15 Rue du Mt. Blanc,
Geneva, Switzerland
Filed Jan. 9, 1964, Ser. No. 336,769
1 Claim. (Cl. 310—112)

My present invention relates to an electric generator serving to convert magnetic force into electric energy with the aid of two relatively rotatable members, i.e. a stator and a rotor, one of these members being provided with electromagnetic or permanent-magnetic means adapted to induce a voltage in a winding forming part of an output circuit on the other member.

Conventional generators of this type utilize a winding whose conductors form loops in different axial planes whereby, upon relative rotation of the two members, diametrically opposite portions of each loop pass twice per revolution through the field of each pole pair of the magnetic inductor member (usually the stator). If the loops are open-circuited, no current flows in the winding and no reaction torque is developed so that the rotor will be free to turn at the maximum speed of its driving unit. As soon as the output circuit including the winding is short-circuited or connected across a load, the resulting current flow tends to retard the motion of the rotor to an extent dependent upon the magnitude of the current, it being therefore necessary to provide compensating speed-regulating devices if it is desired to maintain a substantially constant terminal voltage. Moreover, the variable reaction torque subjects the rotor and its transmission to considerable mechanical stresses which, in the case of widely fluctuating load currents, may lead to objectionable strains.

It is, therefore, the general object of my present and new invention to provide an electric generator which obviates the aforedescribed disadvantages.

A more particular object of my invention is to provide a generator of such construction that its reaction torque and, therefore, its rotor speed in response to a given driving torque varies but little upon changeover from open circuit to current delivery or vice versa.

It is also an object of this invention to provide an electric generator whose terminal voltage varies at a considerably lesser rate than its rotor speed so as to be less affected than conventional generators by fluctuations of its driving rate.

I have found, in accordance with this invention, that the foregoing objects can be realized by the relative rotation of an elongated ferromagnetic element, such as a bar-shaped soft-iron armature, and a pair of pole pieces defining an air gap wherein a magnetic field is set up under the influence of a suitable source of coercive force. The armature carries a winding, advantageously in the form of two series-connected coils embracing opposite extremities thereof, which is included in an output circuit adapted to be connected to a load. As the armature rotates within the stationary air gap (or, conversely, the pole pieces swing about the stationary armature), the magnetic circuit is intermittently completed and the armature experiences periodic remagnetizations with successive reversals of polarity.

When the output circuit is open, the mechanical energy applied to the driven rotor member is converted, to the extent that it is not needed to overcome frictional resistance, into work of magnetization which in turn is dissipated as heat; in actual practice, however, the resultant rise in the temperature of the armature will be hardly noticeable, particularly if the armature is part of the continuously air-cooled rotor assembly. When the output circuit is closed, part of this work is translated into electrical

energy as the current flow through the winding opposes the magnetizing action of the field and increases the apparent magnetic reluctance of the armature. This explains why, in a system embodying my invention, the speed of the generator remains substantially unchanged when the output circuit is either opened or closed.

As the armature approaches its position of alignment with the gap, the constant magnetic field existing thereacross tends to accelerate the rotation of the armature relative to the pole pieces, thereby aiding the applied driving torque; the opposite action, i.e. a retarding effect, occurs after the armature passes through its aligned position. As the rotor attains a certain speed, however, the flywheel effect of its mass overcomes these fluctuations in the total applied torque so that a smooth rotation ensues.

In a practical embodiment, according to a more specific feature of my invention, the magnetic-flux path includes two axially spaced magnetic fields traversing the rotor axis substantially at right angles, these fields being generated by respective pole pairs co-operating with two axially spaced armatures of the character described. It will generally be convenient to arrange the two armatures in a common axial plane, the two field-producing pole pairs being similarly coplanar. The armatures are preferably of the laminated type to minimize the flow of eddy currents therein; thus, they may consist in essence of highly permeable (e.g. soft-iron) foils whose principal dimension is perpendicular to the rotor axis, the foils being held together by rivets or other suitable fastening means.

If the ferromagnetic elements are part of the rotor, the output circuit will include the usual current-collecting means, such as slip rings or commutator segments, according to whether alternating or direct current is desired. The source of coercive force in the stator includes, advantageously, a pair of oppositely disposed yoke-shaped magnets, of the permanent or the electrically energized type, whose extremities constitute the aforementioned pole pieces. If electromagnets are used in the magnetic circuit, they may be energized by an external source or by direct current from the output circuit of the generator itself.

I have found that the terminal voltage of the output circuit of a generator according to the invention does not vary proportionately to the rotor speed, as might be expected, but drops at a considerably slower rate with decreasing speed of rotation; thus, in a particular unit tested, this voltage fell only to about half its original value upon a cutting of the rotor speed to one-third. This nonlinear relationship between terminal voltage and driving rate enables the maintenance of a substantially constant load current and, therefore, electric output over a wide speed range, at least under certain load conditions, inasmuch as the inductive reactance of the winding is proportional to frequency (and consequently to rotor speed) so as to drop off more rapidly than the terminal voltage, in the event of a speed reduction, with a resulting improvement in the power factor of the load circuit.

If the magnetic circuit includes but a single pole pair per air gap, the flux induced in the relatively rotating armature will change its direction twice per revolution so that each revolution produces one complete cycle of 360 electrical degrees. In general, the number of electrical degrees per revolution will equal 360 times the number of pole pairs, it being apparent that this number ought to be odd since with even numbers it would not be possible to have poles alternating in polarity along the path of the armature and also to have the north and south poles of each pair at diametrically opposite locations. In any case it is important to dimension the confronting arcuate faces of the pole pairs in such manner as to avoid bridging of adjoining poles by the armature, hence it behooves to make the sum of the arcs spanned by these faces (in the plane of rotation) equal to considerably less than 360° electrical.

The invention will be described hereinafter with greater detail, reference being made to the accompanying drawing in which:

FIGS. 1 and 1A illustrate a first embodiment of my invention in axial section and in a cross-sectional view taken on line IA—IA of FIG. 1, respectively;

FIGS. 2 and 3 are perspective views illustrating two further embodiments;

FIGS. 4 and 5 diagrammatically illustrate two output circuits for a generator according to the invention, designed respectively for direct and alternating current; and

FIG. 6 is a somewhat diagrammatic illustration of an arrangement for comparing the outputs of a conventional generator and a generator according to the invention.

The generator **100** shown in FIGS. 1 and 1A comprises a stator member **101** and a rotor member **102**, the latter comprising a pair of laminated armatures **102'**, **102''** carried on a shaft **103** which is rotatably journaled in end plates **104'**, **104''** of a generator housing **104** of nonmagnetic material (e.g. aluminum) rigid with the stator. Shaft **103** is coupled with a source of driving power indicated diagrammatically by an arrow **110**.

The stator **101** includes a pair of yoke-shaped laminated electromagnets **101'**, **101''** whose extremities form two pairs of coplanar pole pieces respectively designated **101a**, **101b** (north) and **101c**, **101d** (south). The pole pieces have concave faces confronting complementarily convex faces **102a**, **102d** of armature **102'** and **102b**, **102c** of armature **102''**. These faces, whose concavities are all centered on the axis of shaft **103**, extend over arcs of approximately 20 to 25° each in the plane of rotation (FIG. 1A) so that the sum of these arcs adds up to about 90° geometrical and electrical.

The magnets **101'**, **101''** of the stator are surrounded by respective energizing windings **109'**, **109''** which are connected across a suitable source of constant direct current, not shown. Similar windings, each composed of two series-connected coils **106a**, **106d** and **106b**, **106c**, surround the rotor armatures **102'** and **102''**, respectively. These coils form part of an output circuit which further includes a pair of brushes **107'**, **107''** that are carried by arms **108'**, **108''** on housing **104** with mutual insulation; brushes **107'**, **107''** co-operate with a pair of commutator segments **105'**, **105''** (see also FIG. 4) which are supported by a disk **105** of insulating material on shaft **103**. By virtue of the series connection of coils **106a**–**106d** between the segments **105'** and **105''**, as illustrated in FIG. 4, the alternating voltage induced in these coils gives rise to a rectified output voltage at brushes **107'** and **107''**; the unidirectional current delivered by these brushes to a load (not shown) may be smoothed, in a manner known per se, by conventional filter means represented diagrammatically by a condenser **112** in FIG. 4.

In FIG. 2 I have shown a modified generator **200** whose housing **204** supports a stator **201** consisting essentially of two permanent bar magnets **201'** and **201''** extending parallel to the drive shaft **203** on opposite sides thereof, each of these magnets being rigid with a respective pair of pole shoes **201a**, **201c** and **201b**, **201d**. Rotor **202** comprises a pair of laminated armatures **202'**, **202''**, similar to those of the preceding embodiment, whose output coils **206a**, **206b**, **206c**, **206d** are serially connected between a slip ring **205'**, supported on shaft **203** through the intermediary of an insulating disk **205**, and another terminal here represented by the grounded shaft **203** itself. Slip ring **205'** is contacted by a brush **207** on a holder **208**, the output of this brush being an alternating current of a frequency determined by the rotor speed.

In FIG. 3 I have shown a generator **300** basically similar to generator **100** of FIGS. 1 and 1A, its shaft **303** carrying a pair of laminated soft-iron armatures **302'**, **302''** rotatable in the air gaps of a pair of electromagnets **301'**, **301''** bearing energizing windings **309'** and **309''**. The commutator **305** again co-operates with a pair of brushes of which only one, designated **307**, is visible in the figure. This brush, carried on an arm **308**, is electrically connected to a brush **313** engaging a slip ring **314** on an extremity of shaft **303** which also carries two further slip rings **315'**, **315''** in conductive contact with ring **314** but insulated from the shaft. Two further brushes **316'**, **316''** contact the rings **315'**, **315''** and are respectively connected to windings **309'** and **309''**, respectively, the other ends of these windings being connected to an analogous system of brushes and slip rings on the opposite shaft extremity whereby the two commutator brushes are effectively bridged across the windings **309'** and **309''** in parallel. In this embodiment, therefore, the stator magnets are energized from the generator output itself, it being understood that the magnets **301'** and **301''** (made, for example, of steel rather than soft iron) will have a residual coercive force sufficient to induce an intial output voltage as is known per se. Naturally, the circuits leading from the brushes **307** to the windings **309'**, **309''** may include filter means as described in connection with FIG. 4.

In FIG. 6 I have shown a test circuit designed to compare the outputs of a generator according to the invention, such as the unit **100** of FIGS. 1 and 1A, with a conventional generator **400** of the type having a looped armature **402** rotatable in a gap of a stator magnet **401** with energizing winding **409'**, **409''**. The two generators are interconnected by a common shaft **103** carrying a flywheel **117**, this shaft being coupled via a clutch **118** to a drive motor **111** whereby the rotors **402** and **102** of both generators are rotatable in unison as indicated by arrow **110**. Two batteries **120** and **420**, in series with switches **121** and **421**, are representative of means for supplying direct current to the stator windings **109'**, **109''** and **409'**, **409''** of the two generators.

The rectified output of generator **100** is delivered to a load **122**, here shown as three series-connected incandescent lamps with a combined consumption of 500 watts, generator **400** working into an identical load **422**. Two wattmeters **123** and **423** have their voltage and current windings respectively connected in shunt and in series with the associated loads **122** and **422** to measure the electric power delivered by each generator.

Upon engagement of the clutch **118**, shaft **103** with its flywheel **117** is brought to an initial driving speed of 1200 r.p.m. whereupon the switch **421** in the energizing circuit of conventional generator **400** is closed. The lamps **422** light immediately and the corresponding wattmeter **423** shows an initial output of 500 watts; this output, however, drops instantly as the flywheel **117** is decelerated by the braking effect of the magnetic field upon armature **402**.

Next, the procedure is repeated but with switch **421** open and switch **121** closed to energize the generator **100**. The lamps **122** light up and the wattmeter **123** shows an output of 500 watts which remains constant for an indefinite period, there being no appreciable deceleration of flywheel **117**. When the clutch **118** is released and the rotor speed gradually decreases, the output of generator **100** is still substantially 500 watts at a speed of 900 r.p.m. and remains as high as 360 watts when the speed drops further to 600 r.p.m.

In a similar test with a generator of the permanent-magnet type, such as the one shown at **200** in FIG. 2, a substantially constant output was observed over a range of 1600 to 640 r.p.m.

Modifications of the specific arrangements described and illustrated will, of course, be apparent to persons skilled in the art and are deemed to be embraced in the spirit and scope of my invention as defined in the appended claim.

I claim:

1. An electric generator comprising a fixed stator and a rotor coaxial with said stator; drive means for rotating said rotor about its axis, said stator being provided with a pair of elongated bar magnets extending parallel to said axis on opposite sides thereof and terminating in transverse extremities, oppositely poled extremities of said magnets confronting each other and defining magnet means having two axially spaced pole pairs disposed in a common axial plane and forming a pair of diametrically extending air gaps for establishing a magnetic-flux path including two axially spaced parallel magnetic fields across said air gaps traversing said axis substantially at right angles, said rotor being provided with two axially spaced parallel elongated ferromagnetic elements slightly shorter than the spacing of said confronting extremities and extending perpendicularly to said axis at locations coplanar with said pole pairs for concurrent periodic alignment of said elements with said fields in said air gaps upon rotation of said rotor; and an output circuit on said rotor including winding means on each of said elements and collector means in series with said winding means, each of said pole pairs and the corresponding elements having confronting arcuate faces centered on said axis, the sum of the arcs spanned by said faces being substantially equal to 90° in the plane of rotation.

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Appendix #2

Operating Principles of the Ferromagnetic Generator

Written by Raymond Kromrey

OPERATING PRINCIPLES OF THE FERROMAGNETIC GENERATOR

by the inventor
R. Kromrey

The energy relationships valid for earth's system of reference are as follows :

1 kg-m/sec = 9.81 Watts = 2.3 cal/sec
(1ft.lb/sec = 1.36 Watts = 0.32 cal/sec)

A conventional dynamo transforms the earth's gravitational energy into electrical energy. In a very wide sense the figures given above are considered valid throughout the entire universe although gravity and, at the same time, acceleration can differ considerably from system to system.

It is well known that the notion of gravity is of primordial importance because it is from gravity alone that the entire science of dynamics is derived.

Having said that, the principle difference between a conventional generator and the ferromagnetic generator is that the former converts the earth's acceleration into electrical energy (using Lorentz's force as an intermediary) whereas the ferromagnetic generator transforms or converts ferromagnetic attraction directly into electrical energy.

It is not entirely fortuitous that the universal formula for gravity and the Coulomb-Poisson formulae have a similar structure :

$$F = \frac{k\ M1 \quad M2}{d^2}$$

the only essential difference being the presence of the coefficient "k".

Apart from this, it is useful to note that the fundamental principle of the conservation of energy lies with the quantative conservation of motion - anything beyond this remains purely speculative.

What then, are the principal characteristics of the molecular generator ?

We are speaking here of a type of monophase transformer with the peculiarity that the cores, respectively parallel, two-by-two, make up the stators and rotors. Preferably, the stators should be powerful permanent magnets and the rotor cores should be of soft iron.

When the armature turns, it successively enters and leaves the earth's gravitational field and the magnetic field, and vice versa, in such a way that the soft iron cores are subjected successively to a magnetic attraction and the earth's gravitational attraction.

Since, on the other hand, each action has an equal and opposite reaction, and Weight = Force = Mass x acceleration:

$$W = m.g$$

the production of electricity can be explained quite easily through classical dynamics.

In effect, we know that the electron possesses a mass. For an electric motor, the magnetic field (or inductor) has only a secondary role, that of deflection, in such a way that the electronic kinetic energy $E = \frac{m v^2}{2}$ (for example the output from a battery), remains conserved if the motor runs without load.

It is exactly the same if the machine works as a generator: the maghetic field has merely an intermediary role of transforming kinetic energy - in this case resulting from the earth's gravitational system - into electrical energy.

For the molecular generator, things happen very differently. Here, the rotor is subjected alternatively to an extra-terrestrial acceleration, enormously superior to that of the earth's gravity, which produces an electronic current.

Since Newton's third law is fundamental, because it even includes the principal of the conservation of energy, the working of the molecular generator is easily explained.

In effect, the two twin cores constituting the rotor, fall from the earth's gravitational field into the more intense magnetic field, and grow heavier because of this.

If, simultaneously, an electric current is produced by short-circuiting, for example, the winding of the armature, it can be seen that the magnetic acceleration first observed, purely with regard to the armature , is subsequently partially consumed in order to accelerate the electrons.

Since the initial acceleration of the rotor diminishes to the advantage of an electronic acceleration, the rotors become lighter. In other words the attraction between rotor and stator disappears so that the rotor continues to turn freely while producing an electric current.

This is completely normal, since a soft-iron induction coil (or rotor) that has become heavier in a magnetic field is essentially subject to the expression :

Mass x Acceleration $\equiv$ Weight

and which, on expending its acceleration in favour of a movement of electrons, must obviously lose its attraction for the stator.

Naturally, the foregoing is only understandable if one remembers that, before anything else, electricity obeys the laws of classical dynamics. Electricity is, after all, a branch of mechanics, and not the reverse as the theory of general relativity postulates.

People have always tried to complement Newton's concepts, whereas, in fact, everything was already contained in his work, even the unified field theory.

Here is the explanation :

In Newton's time, it was usual to measure gravitational force by using a simple pendulum and the formula for the duration of an oscillation given by Huygens :

$t = 2\pi\sqrt{\frac{1}{g}}$ from which is derived:

$T^2 = 4\pi^2\ \frac{1}{g}$ $(g = G)$

G = Acceleration due to the earth's gravity.

Since the density of the earth is not the same for all locations, this simple instrument could be usefully employed in geological prospecting because where mineral deposits exist for example, the pendulum would oscillate more quickly.

At the same time it is quite remarkable that, in itself, the pendulum is the differential of a fly-wheel. Here is the proof :

(diagram ici)

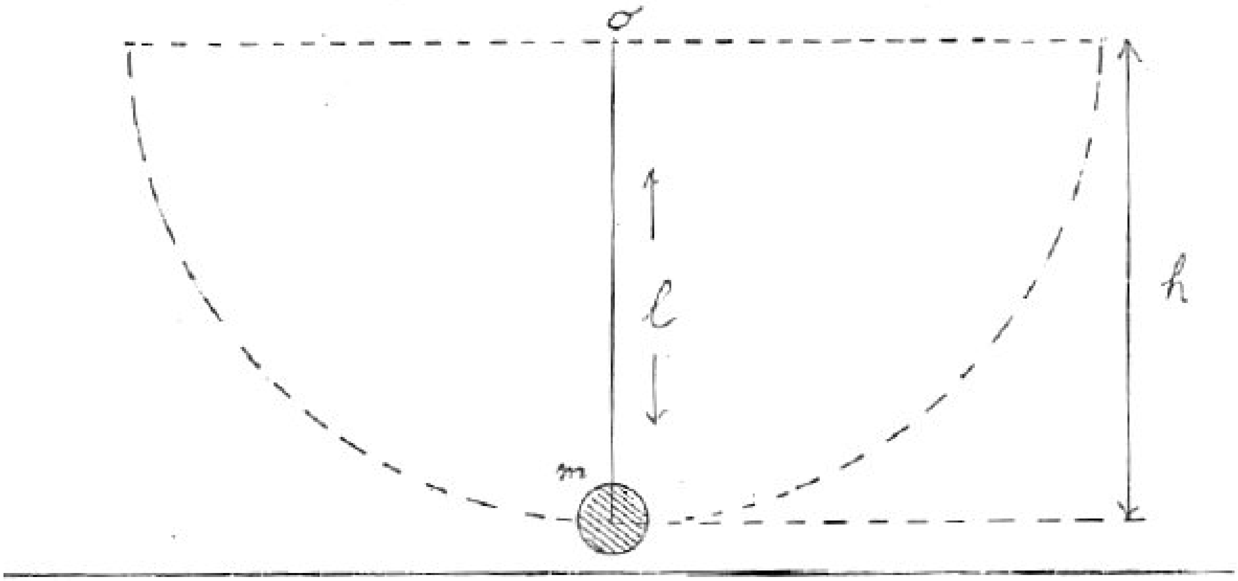
A mass "m" turning around a lever arm of a length "1" has a potential drop of "h". One complete oscillation of the pendulum therefore corresponds to a revolution of the mass "m" at a distance "1" from the centre of rotation "o".

The rate of displacement of the mass "m" is expressed in the equation $v = \frac{2\pi 1}{T}$ where T corresponds to the duration of one cycle. Thus in a single cycle, the mass "m" of the pendulum drops twice from the high point (h = 1) so that in one vertical drop, the work performed will be

$$P.\ 21\ .= \frac{m}{2}\,v^2$$

But since the pendulum falls through the arc of a circle, must be written successively :

Diagram



$$P. \quad 2 \quad 1 = \frac{I \quad w^2}{2} \quad (w = \text{omóga}) \; \omega = 2\pi \frac{f}{T}$$

$$P. \quad 1 = I w^2$$

$$m. \, g. \, 1 = m \quad 1^2 \quad (2 \pi f)^2$$

$$g = 1 \cdot 4 \pi^2 \cdot f^2$$

since : $f = \frac{1}{T}$ ~~aussi~~ alors : $1 \cdot \frac{4 \pi^2}{T^2} = g$

then : $T^2 = \frac{1 \cdot 4 \pi^2}{g}$ to give : $T = 2 \pi \sqrt{\frac{1}{g}}$

What is the significance of the fact that a pendulum is the differential of a fly-wheel ? Quite considerable, as one can see from the following :

If for exampèe, a fly-wheel of considerable mass is placed on the moon at a speed of 1500 rpm, very little energy is expended because the lunar force of attraction is 163 cm/sec.^{2}, minimal compared with the earth's force of attraction of 981 cm/sec^2.

If the same fly-wheel could be transported immediately within the earth's gravitational field, its rate of rotation would be in no way diminished. On the contrary, the speed of rotation will have a tendency to increase even more and also result in a considerable gain in kinetic energy - and this without coming into conflict with the principal of the conservation of energy.

In other words, if the mass of a body drops in free fall towards the earth's surface, it will travel 4.91 metres during the first second. The same mass falling towards the moon's surface will have travelled only 0.81 metres after the first second. Masses possessing weight and masses that are inert are therefore quite different in the two systems of referenco, and it is the same for the respective kinetic energies.

Schools, however, teach the following:

Thh fact that a body has a mass means, in the first place, that a force is necessary in order to accelerate it; but this would also be the case if the body was not attracted towards the earth's surface - in other words if it was weightless - and from this can be deduced the fact that notions of weight and of mass have absolutely nothing in common.

At the same time, when defining the concept "mass" and the concept "Weight", gravity has been excluded which is obviously an error.

Mach's law no longer holds good. According to Ernst Mach,and also Albert Einstein, inertia is a property of a mass determined by the presence of all the other masses in the universe.

In fact, inertia is in direct correlation with the finite and therefore the contrary of infinity. The system of reference can be determined. For this reason, unity should be defined as acceleration itself. The unity of mass will in future be the mass exerted on a mass identical to the distante 1, acceleration 1.

It is impossible to agree with schools of thought that maintain the following :
to put a ball of iron in motion on the moon will require the same effort as that required to make the same ball of iron in motion on earth.

The example cited corresponds exactly with the experiment of the fly-wheel - set in motion on earth at one time, then at another time on the moon. In the end, it is not the kilogram-masses that have to be moved but the kilogram-weights.

The amount of mouvement released by an action is essentially linked to the binary system of reference.

The invariability or stability of the oscillation path of the pendulum in Foucault's famous experiment at the Pantheon in Paris, designed to demonstrate the earth's rotation, is not a result of the presence of all the other stellar masses but is a direct result of the mutual attraction of the terrestrial mass and the mass of the pendulum.

Newtonian gravitation is based on instantaneous action at a distance, an opinion which is not questioned . On raising the mass of a litre of water (1'000 grams) to the top of the Eiffel Tower in Paris (300 metres) the water will lose one ten-thousandth of its weight. At 10 kilometres its weight will be only 965 kf and, 10'000 kilometres, only 151 kf.

It is the minute loss in weight by a body raised to considerable distances above the earth's surface that is the real equivalent to the work performed.

The expression "potential energy" is an unfortunate term used to imply that a certain tension exists between two masses that are trying to unite.

In the terrestrial system of reference, it is clear that if a body is raised to a certain weight (even of several kilometres) it will only lose a minute part of its weight. This is because it is the enormous mass of the earth - to all intents and purposes alone - which is responsible for the effect of gravity.

It is therefore logical that a body raised to a height "h" corresponds to an amount of work that is practically recuperated if the body is released to make the return journey.

The molecular generator uses, therefore, a gravitational effect (ferromagnetism) to accelerate the electrons. A soft-iron armature is caught by a magnetic field and becomes very heavy over a distance of several centimetres, as it leaves the superimposed acceleration of the locally very intense magnetic field.

The molecular generator can produce energy on two inverse paths, that is to say, as the rotor approaches the stator and also as the rotor moves away from the stator. If the rotor enters the magnetic field (a gratuitous effect), the current produced destroys the attraction. If the rotor leaves the primary magnetic field, then the secondary field gratuitously formed by influence, disappears, causes cut-off, then once more - production of electricity. It is true that for each isolated system of reference the theoretical yield cannot be greater than 1. But the forces of various systems can, at the same time, be very different.

Also, when two gravitational fields become partners, it is possible (and without contradicting the principal of the conservation of energy) that the following expression is valid:

$$\frac{\text{force recovered}}{\text{force expended}} > 1$$

In other words, each time that two gravitational fields come into action, it is possible to produce energy cheaply.

Again, for example, machinery driven by tidal motion uses the flux and reflux of the sea. The action of the moon's gravitational field associated with the terrestrial field (working at a distance of 384,400 kilometres) raises enormous masses of water to a height of metres, twice every 24 hours, at absolutely no cost - equivalent to approximately 10^{16} kfm of kinetic energy.

This is similar to what happens in the case of the molecular generator. On the one hand, the rotor is subjected to the earth's gravity; and on the other hand, to magnetic gravity, to give another possibility of producing energy cheaply.

To conclude, Newton's Law of Motion are confirmed, with the suggestion that a fourth law be added as follows :

The energy in any given system can only be modified in a finite time peculiar to this system. This results in a variety of forces for different isolated systems.

Here, then, are the principal distinctions between a conventional permanent-magnet dynamo and a molecular generator equipped with permanent magnets of the same force :

1. Theoretically the dynamo is not limited in output- the faster it turns, the bigger the output.

2. For 1 kg/s the dynamo produces 9.81 Watts.

3. A dynamo transforms acceleration due to the earth's gravity (981 cm/sec^2) into electrical energy.

4. When short-circuited, the dynamo has a maximum braking effect on the source used to drive it, e.g. motor, turbine, fly-wheel.

5. The molecular generator can only deliver a given amount of power.

6. This power is limited by the capacity of the permanent magnets with which it is equipped.

7. At low speed, i.e. low frequency, the amplitude of the intensity curves are large.

8. At high speed the amplitude of the intensity curves are small and the periods numerous.

9. In the two cases cited above, the output remains the same.

10. The molecular generator transforms the acceleration due to a permanent magnetic field into electrical energy.

11. In short-circuiting, the molecular generator has a minimum brakigg effect.

NEW ELECTRIC GENERATOR

This concerns a fully new type of electric generator which operates according to physical theories developed over the last 25 years and which took more than ½ million Swiss francs investments for research and testing.

It is now ready for industrial production as working prototypes can demonstrate. It is protected by international patents.

The main caracteristics of this generator are:

1. Almost constant electric power output in spite of a variation range of its rotor speed of about 35% (cf. output curve : ----- AB, on diagram).
2. Ability to work under short-circuiting conditions without heating of its rotor or any other part and without braking effect. (no back torque)
3. High production efficency (ratio output/driving force), better than on conventional equipement (cf. curve ---- and curve ——— at same speed. D & A level, on diagram).
4. Produces alternative current; frequency adaptable to existing frequency of electric power networks on which it will be connected.
5. Rotor requires a rotating speed of about 1200 ± 400 RpM.
6. Construction costs about 30% under costs of traditional equipement of same installed power, because of more simple construction, tooling and engineering.
7. For certain construction particularities the use of this generator is manly appropriated for important pover level, above a minimum of 1.000 KVA.

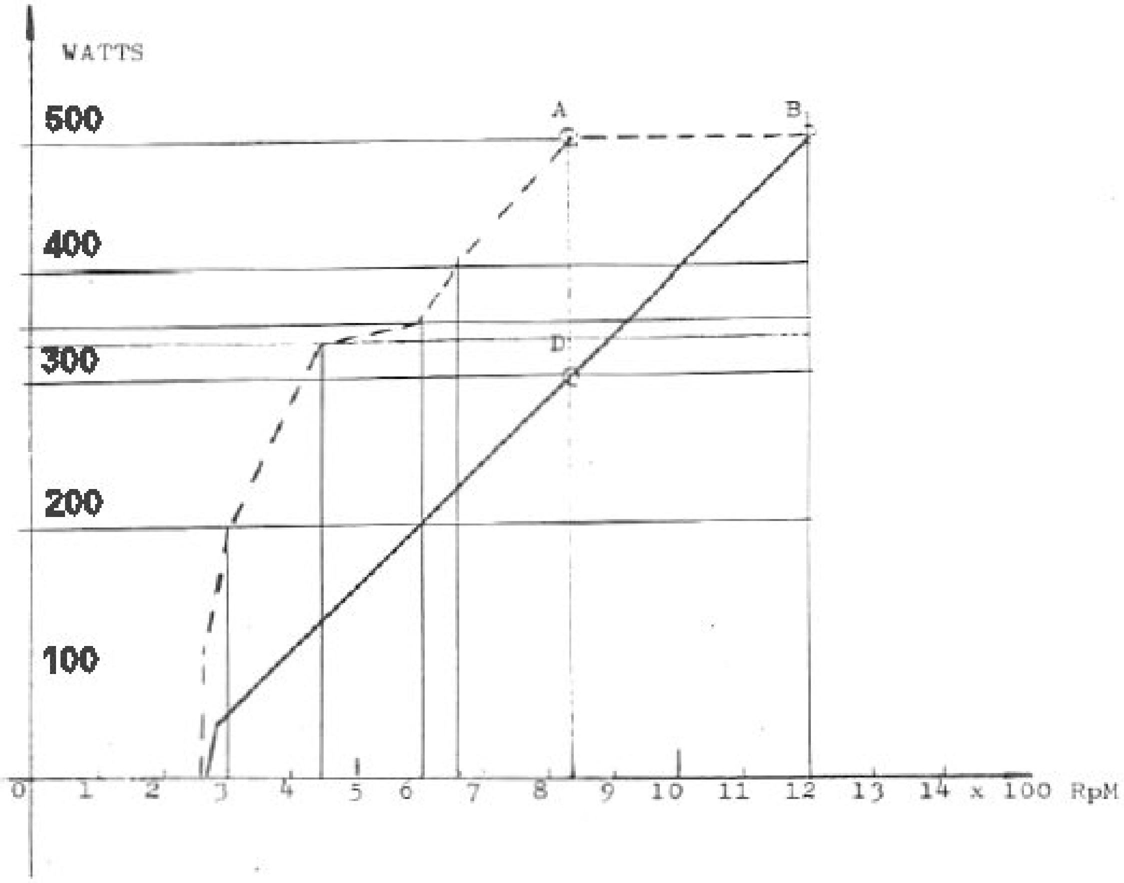
diagram attached.

NEW ELECTRIC GENERATOR

This diagram shows the comparaison between the new electric generator and the classical generator. Difference between their output force / driving speed ratio. (WATTS/RpM).

----- curve of new generator

——— curve of classical generator



Appendix #3

Great Britain Patent #14,311

System for the Generation of Electric Currents
Issued to Carlos F. Benitez

Nº 14,311 A.D. 1915

Date of Application, 9th Oct., 1915
(Patent of Addition to No. 17,811, 28th July, 1914)
Complete Specification Left, 5th Feb., 1916
Complete Specification Accepted, 17th Aug., 1916

PROVISIONAL SPECIFICATION.

System for the Generation of Electric Currents.

I, Carlos F. Benitez, Civil Engineer, of 141, Ocampo Street, in Guadalajara, Mexico, do hereby declare the nature of this invention to be as follows:—

The invention which forms the object of this Patent of Addition, relates to new improvements in the system for the generation of electric currents, described in the main Patent No. 17,811, filed July 28th, 1914, and in the Patent of Addition No. 5591, filed 14th April, 1915.

The said system may be still further simplified and improved by the addition of batteries of accumulators, which suitably adjusted in conjunction with the said described system, can be charged and discharged alternately, producing furthermore an excess of electrical energy, that can be employed at will, for any purpose outside the automatic operation of the arrangement under description.

In other words, in this arrangement I use synthetically in combination: two groups of accumulators connected in series; two groups of accumulators connected in parallel; both said groups disposed in such way as to utilise the discharge of one of them, for the charging of the other, and *vice versa*; and means for the application of the energy produced by any of the methods described with reference to the English Patents No. 17,811/14 and No. 5591/15, in order to increase the effect of the discharges of each group of accumulators when acting from one to another; and means for reversing the operations of such groups.

Another object of this new arrangement is to provide means for the operation of said system, using low voltages, condensers of small capacities, and greater facilities for starting.

The advantages of such an improvement will be better understood by considering the adjoining drawing, which illustrates one method of carrying out the invention:

In the figures: 1, 2, 3, 4, are batteries of accumulators, that once charged from some exterior electrical source, will maintain their charges indefinitely, in the following manner:

With the connections established as shown in the figure, *i.e.* when accumulators 1—2 are connected in series through switch 5, (switch 6 being opened): the accumulators 3—4 are connected in parallel through switch 7, (switch 8 being opened).

Under these conditions, supposing the four batteries to be alike, if battery 1—2, has been previously charged from some exterior source; when discharging they will have a voltage superior to the counter electromotive force opposed by the batteries 3—4 receiving such discharge. In other words, if by means of the conductor 13 the positive pole 9 of battery 1—2, is connected to the positive poles 10, 32, of batteries 3—4, and both negative poles 11, 12 of both batteries are connected together; an electric current will be established from

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battery 1—2, to batteries 3—4, until the voltages of both batteries are alike. Of course the current furnished by the discharge of battery 1—2 alone, would produce a smaller charge in the batteries 3—4, but that current can be increased by any of the methods already described in the aforesaid Patents No. 17,811/14, and 5o91/15, and by these means it is always possible to charge and discharge alternately each battery 1—2 and 3—4, from one to another, keeping constant a predetermined charge, and furthermore producing an excess of electrical energy, that can be employed at will.

With these objects in view, and using as an illustration the arrangement shown in the Sheet 1 (Figure 1) of the Patent of Addition No. 5591/15; the condenser 14 is connected in series in the conductor 13. In the same manner, the primary 15 of an ordinary induction coil provided with an interrupter, is connected by each of its poles 16, 17, to the same wire 13. The secondary of same induction coil is connected by each of its poles 18, 19, to the poles 20 and 21, of the second condenser or battery of condensers 22. These same poles are furthermore connected through the spark gap 23, with the poles 24, 25, of the primary 26, of a high-frequency transformer. The secondary 27 of this same transformer is connected by each of its poles 28, 29, with the poles 16, 17, of the induction coil 15. Finally both poles of condenser 14 are connected to the conductors 30, through which a part of the electrical energy provided by these means, can be shunted and employed at will.

This arrangement being made, the electrical energy stored by the accumulators 1—2, passing through the pole 9, wire 13, primary 15 of the induction coil, pole 10 of the accumulators 4, pole 31 of switch 7, and pole 32 of accumulators 3, will go back through pole 12 to the same battery 1—2.

As a consequence of the passage of this electric current through the primary 15 of said induction coil; high-tension currents will be obtained in its secondary, which being collected by the condenser 22, will finally produce high-frequency currents through the primary and secondary of the high-frequency transformer. On the other hand, inasmuch as the poles 28, 29, of this transformer are connected with the poles 16, 17, of the induction coil, said currents will greatly increase the number of amperes furnished by the accumulators 1—2, and the storage batteries 3—4 receiving thus a proper amount of current can be fully charged by these means. The excess of the electrical energy thus obtained can be shunted through the conductors 30, in order to be employed at will, as has been stated.

Under these conditions, as the voltage in one of the batteries is decreasing, and increasing in the other, after some hours work both voltages become alike, and then it is impossible to produce any movement of electricity from one to the other battery, unless the switches 5, 6—, 7, 8, are operated for that purpose. Speaking in other terms, inasmuch as battery 3—4 is charged, and battery 1—2 is almost discharged, if the functions of said batteries are now reversed, the original conditions can be established once more, and the same operations repeated entirely as before.

In order to attain these results, the switches 5 and 7 that were closed, must now be opened, and the switches 6 and 8 that were opened, must now be closed. That is to say, the batteries 3—4 being thus connected in series, and the batteries 1—2 being connected in parallel, the former conditions are reversed, and a current will be caused now from battery 3—4, to batteries 1—2, through the primary 15 of the induction coil, thus obtaining the same results, as often as these operations are performed.

When the resistance offered to the passage of, the electric currents by the primary of the transformer 15 is not high, it is possible to simplify the former arrangement obtaining the high-frequency currents directly from the same induction coil 15, in which case the poles 18, 19 of the secondary of said coil must be connected to the poles 16, 17, of the same said coil, and the second battery of condensers 22 and high frequency transformer 26, 27, can be omitted.

Under these conditions the breaker or interrupter employed in said induction coil, acts as spark-gap, and the condenser 14 discharges in the form of oscillations through the primary 15 of same coil, thus directly increasing the amount of electrical energy furnished by the accumulators.

Dated this 9th day of October, 1915.

CARLOS F. BENITEZ.

COMPLETE SPECIFICATION.

System for the Generation of Electric Currents.

I, CARLOS F. BENITEZ, of 141, Ocampo Street, in Guadalajara, Mexico, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The invention which forms the object of this Patent of Addition, relates to new improvements in the system for the generation of electric currents, described in the main Patent No. 17,811 filed on July 28th, 1914, and in the Patent of Addition No. 5591 filed on April 14th, 1915.

The said system may be still further improved by the addition of batteries of accumulators which suitably adjusted in conjunction with the said described methods, can be charged and discharged alternately, and by so doing, an excess of electrical energy that can be employed at will, independently of the automatic operation of the arrangement under description, can be still further obtained.

In other words, in this arrangement I use synthetically in combination: one or more batteries of accumulators already charged by proper means and connected in series; a second battery or batteries of accumulators connected in parallel, series-parallel or in any other manner producing an inferior voltage to that obtained in the first battery or batteries; both said batteries arranged in such a way as to utilise the discharge of the accumulators connected in series, for the charging of the accumulators of the second battery or batteries; and means for generating high frequency currents, through the circuit connecting both batteries of accumulators, in order to increase the energy of the discharges of each of said batteries when acting from one to the other, securing thus the charging of the second group of accumulators, while the first battery is discharging or *vice-versa*, and producing furthermore a surplus of energy that can be employed at will, without impairing the normal running of this described arrangement; and finally means for the application of this extra energy to any outside purpose.

In this manner, the current given by the battery of accumulators connected in series, is increased when discharging by the electrical oscillations produced by proper means in the same said circuit connecting both groups of accumulators, and the second battery connected in parallel can be thus fully charged, while the first battery is discharging. On the other hand, as the number of electrical oscillations per second can be increased at will in the same said circuit, an excess of electrical energy can be obtained by this process, and the surplus of this energy, can be applied to any outside purpose, without impairing the normal running of the process as above stated.

The advantages of such an improvement will be better understood by considering the drawing left with the Provisional Specification and the annexed sheet which illustrate two different methods of carrying out the invention.

In both drawings: 1—2 and 3—4, are batteries of accumulators that once charged from some exterior electrical source, will maintain their charges indefinitely in the following manner:

With the connections established as shown by both drawings: *i.e.* with the accumulators 1—2 connected in series and the accumulators 3—4 connected in parallel, if battery 1—2 has been previously charged from some exterior source; when discharging it will have a voltage superior to the counter electromotive force opposed by the battery 3—4 receiving such discharge. In other words, if by means of the conductor 13, the positive pole 9 of battery 1—2, is connected to the positive pole 10 of battery 3—4, and both negative poles 11 and 12 of both batteries are connected together, an electric current will be established from battery 1—2 to battery 3—4 until the voltages of both batteries become alike. Obviously the current furnished by the discharge of battery 1—2 alone, would produce a smaller charge in the batteries 3—4, if some extra energy were not added to the normal output of said battery 1—2.

With this object in view any of the known methods for the generation of high-frequency currents, as well as those described in the aforesaid Engish Patents No. 17,811/14 and 5591/15, can be employed in conjunction with said batteries of accumulators, in order to provide that complementary energy, and in this manner it is always possible to charge and discharge alternately each battery from one to the other, maintaining constant a storage of electricity and producing furthermore an excess of electrical energy.

Another object of this new arrangement is to provide means for the operation of these same said methods described by the afore said English Patents, using low voltages, condensers of small capacities, and greater facilities for starting.

Referring now particularly to the arrangement shown by the drawing left with the Provisional Specification: the primary 15 of an ordinary induction coil, provided with its condenser 14, and a suitable interrupter (not shown in the figure), is connected in series to the above stated batteries 1—2 and 3—4 through the wire 13. The secondary of same induction coil is connected by each of its poles 18, 19, to the poles 20 and 21 of the second condenser or battery of condensers 22. These same poles are further more connected through the spark-gap 23, with the poles 24, 25, of the primary 26 of a high-frequency transformer. The secondary 27 of this same transformer is connected by each of its poles 28, 29, with the poles 16, 17, of the induction coil 15. Finally both poles of condenser 14 are connected to the conductors 30, through which a part of the electrical energy provided by these means, can be shunted and utilised at will.

This arrangement being made, the electrical energy stored by the accumulators 1—2 passing through the pole 9, wire 13, primary 15 of the induction coil, pole 10 of the accumulators 4, pole 32 of the accumulators 3; will go back through pole 12 to the same battery 1—2.

As a consequence of the passage of this electric current through the primary 15 of said induction coil; high tension currents will be obtained in its secondary, which being collected by the condenser 22, will finally produce high-frequency currents through the primary and secondary of the high-frequency transformer. On the other hand, inasmuch as the poles 28, 29, of this transformer are connected with the poles 16, 17, of the induction coil, said currents will greatly increase the energy furnished by the accumulators 1—2, and the storage batteries 3—4 receiving thus a proper amount of current, can be fully charged by these means. The excess of electrical energy thus obtained can be shunted through the conductors 30, in order to be utilised at will, as has been stated.

Under these conditions, as the voltage in one of the batteries is decreasing and increasing on the other, after they have been working some time, their voltages become alike, and then it is impossible to produce any movement of electricity from one to the other, unless their functions are reversed. Speaking in other terms the battery 1—2 connected in series must now be connected in parallel, and *vice-versa* the battery 3—4 connected in parallel must now be connected in series.

With this object in view, and in order to illustrate this particular point, said batteries 1—2 and 3—4, have been connected respectively through the switches 5, 6, and 7, 8, in such a manner that by reversing the position of said switches, the connections of said batteries are easily reversed; but in practice far better results can be attained by the use of the commutator shown in the adjoining Sheet No. 2, as will be further explained.

By these means the original conditions of voltage can be easily re-established each time that the discharging battery is becoming exhausted, and a reverse current can be obtained through the primary 15 of the induction coil, thus securing the same results as often as these operations are performed.

As the resistance offered to the passage of the electric currents by the primary of the transformers is not high, it is possible to simplify the former arrangement obtaining the high-frequency currents directly from the same induction coil 15, in which case the poles 18, 19 of the secondary of said coil must be respectively connected to the poles 16, 17 of the primary of same said coil, and the second battery of condensers 22 and high-frequency transformer 26, 27, can be omitted. Under these conditions the breaker or interrupter employed in said induction coils, acts as spark-gap and the condenser 14 discharges in the form of oscillations through the primary and secondary of same coil, thus directly increasing the amount of electrical energy furnished by the accumulators.

Such arrangement is particularly illustrated in the annexed sheet Fig. 1, in which: each one of the poles of the accumulators composing the batteries 1—2 and 3—4, are correspondingly connected to the several poles of a commutator 31.

This commutator as shown by the figure, consists of a rotary cylinder 32, provided with the conductive paths 33, 34, 35, 36, 37, 38, 39, 40, properly isolated and distributed on its surface, in such way, as to connect alternately in series or parallel the different units composing the above mentioned batteries 1—2 and 3—4.

Same cylinder 32 is furthermore provided at one of its ends, with the two conductive paths 41, 42, that can be better seen in the cross sectional view or Figure 2, the same said cylinder passes through a ring 44, fixed to the same base 31 of the apparatus, and provided with the contacts 45, 46, 47, 48. On the other hand the pole 45 of this ring is connected to the pole 10 of the battery 3—4, and its pole 46 is connected through the wire 49, to the pole 9 of battery 1—2. Pole 47 is connected through wire 13 to pole 16 of the primary of a transformer, and pole 48, is connected through wire 55, to the back contact stud 50 of an ordinary breaker.

A back wall 51, fixed to the same base of the commutator, is provided with the metallic strips or brushes that can be clearly seen in the figure, in contact with the cylinder 32, and connected respectively to each one of the poles of the accumulators; and finally the rotative shaft of same cylinder is provided with a handle or pulley 52 affording means for the operation of this commutator.

Condenser 14 of the induction coil, is connected as usual by its pole 52 to pole 17 of the primary of same transformer, and its other pole 53 instead of being connected to the back contact stud 50 of the breaker, as is generally the case, is grounded through wire 54, and pole 56 of the commutator.

Under these conditions when the circuit is broken by the interrupter, condenser 14 is charged and immediately afterwards discharges *via*: primary 15 of the transformer, secondary of same transformer, wire 55, pole 48, path 41 of the commutator, and battery (3—4) in parallel.

As a consequence of the passage of the electric current produced by this discharge through the primary 15 of the transformer, induced currents are produced in its secondary and one of these currents the inverse passing through pole 19 is immediately utilised for the charging of same said battery in parallel. The direct current that is produced when the discharge of said condenser 14 is finished, passing through pole 18 and entering the primary 15 through pole 16, produces a new charge in the same condenser 14, that again discharges in identical manner, and the same phenomena are reproduced several times in the beats or intervals of breaks and makes produced by the interrupter.

On the other hand, if the pole 56 of the commutator is not grounded, each time that the condenser 14 receives a new charge, the neutral fluid of its outer coating is influenced through its dielectric and an induced electric current is forced to move *via* wire 54 and pole 56. In other words this extra energy equally increases the normal output of said battery 1—2.

By these means the current given by the accumulators connected in series, is properly increased by the induced currents produced in the secondary of the induction coil, and by the rapid chargings and dischargings of the condenser produced in the above described manner, and the accumulators connected in parallel receiving thus a proper amount of current, can be fully charged while the first battery is discharging. However, as the first battery is discharging its voltage is progressively decreasing, and in order to maintain in the circuit a given current for the charging of the second battery, the resistance of the same said circuit must be accordingly reduced.

In order to attain this result without touching the wiring, the back contact stud 50 of the breaker can be adjusted, in order to secure a proper resistance through the interrupter in accordance with the decreasing voltage, and in this manner it is always possible to maintain a given current in the circuit, until the very last limit of energy in the discharging battery is attained.

Better results in every respect can be still obtained by the use of a closed core type transformer combined with an electrolitic interrupter, since with these interrupters practically there is no lost time in the intervals between breaks and makes, and the resistance of such devices can be easily adjusted at a distance wherever the operator may desire.

Once the limit of energy in the discharging battery is attained, the connections of the accumulators must be reversed, and with this object in view the commutator shown by the figure can be employed, and the cylinder 32 must be revolved until the paths 37, 38, 39, 40, come in contact with the brushes connecting the poles of the accumulators, and the contacts 45, 47, are connected through path 42. By so doing the functions of both said batteries are at once reversed, and the accumulators 3—4 being now connected in series, they will discharge through pole 10, *via*: poles 45, 47, wire 13, primary 15, wire 55, pole 48 (now in connection with pole 46 through path 41), wire 49 and pole 9 of battery 1—2, that is now connected in parallel through paths 39, 40.

In other words the working conditions can be thus completely reversed by the simple operation of the commutator, and a continuous current can be maintained through wire 55, in which the primary 57 of an ordinary transformer, or any other suitable device, can be inserted in series, in order to profit the surplus of the electrical energy thus obtained, without impairing in the least the running of the mechanism.

Obviously means can be disposed in order to obtain an automatic operation of the commutator, from time to time, in accordance with the capacity of the accumulators employed, and in consequence, for a given weight of batteries, greater power can be secured by this process, with smaller capacities, than with the greater units, since the same 4 volts can be obtained from a 60 amp.-hours accumulator, as with a 10 amp.-hours capacity.

I desire also to explain clearly that the arrangements shown are entirely illustratives. That in practice in each case the accumulators composing each battery, can be connected as described or a suitable combination of series-parallel can be arranged in each group, and that the connections of the several apparatus employed can be varied in accordance with the particular conditions of power that must be satisfied.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:—

In a system for the generation of electric currents:

System for the Generation of Electric Currents.

1. Disposed in combination: One or more batteries of accumulators already charged by proper means, and connected in series; a second battery or batteries of accumulators connected in parallel, series parallel, or in any other manner producing an inferior voltage to that obtained in the first battery or batteries.; both said batteries arranged in such a way as to utilise the discharge of the accumulators connected in series for the charging of the second battery or batteries; means for generating high frequency currents through the circuit connecting both batteries of accumulators, in order to increase the energy of the discharges of said batteries, and for utilising part of this energy thus increased in any outside purpose; and means for reversing from time to time the respective connections of such batteries; all substantially as herein described and for the specified objects.

2. Disposed in combination: Mechanisms or apparatus arranged, connected and operating substantially in the manner described, in connection with the appended drawings and for the purposes shown.

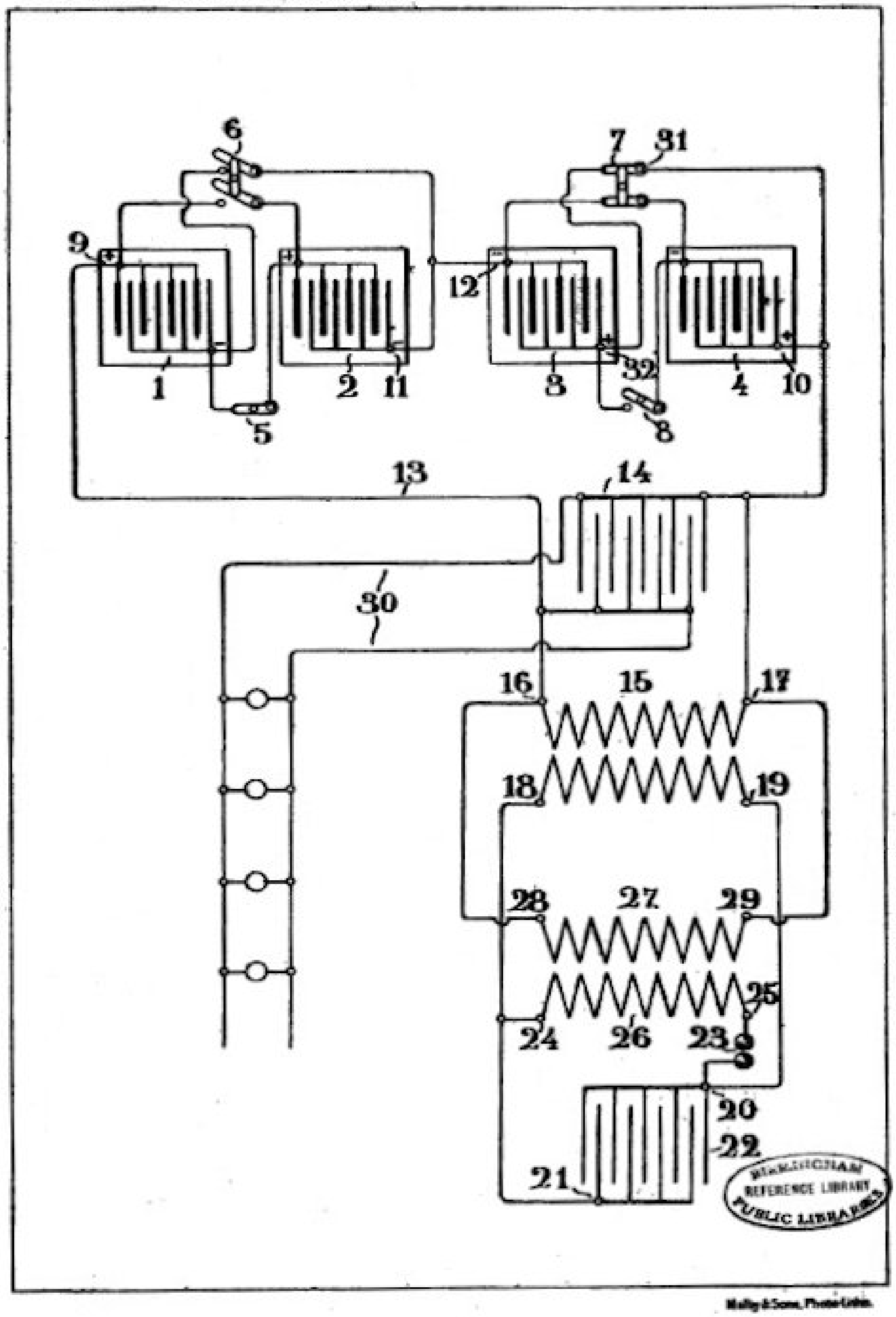
Dated the 4th day of February, 1916.

CARLOS F. BENITEZ.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1916.

A.D. 1915. Oct. 9. N° 14,311.

BENITEZ'S PROVISIONAL SPECIFICATION. (1 SHEET)



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A.D. 1915. Oct. 9. No 14,311.
BENITEZ'S Complete Specification.

(2 SHEETS)

Fig. 1

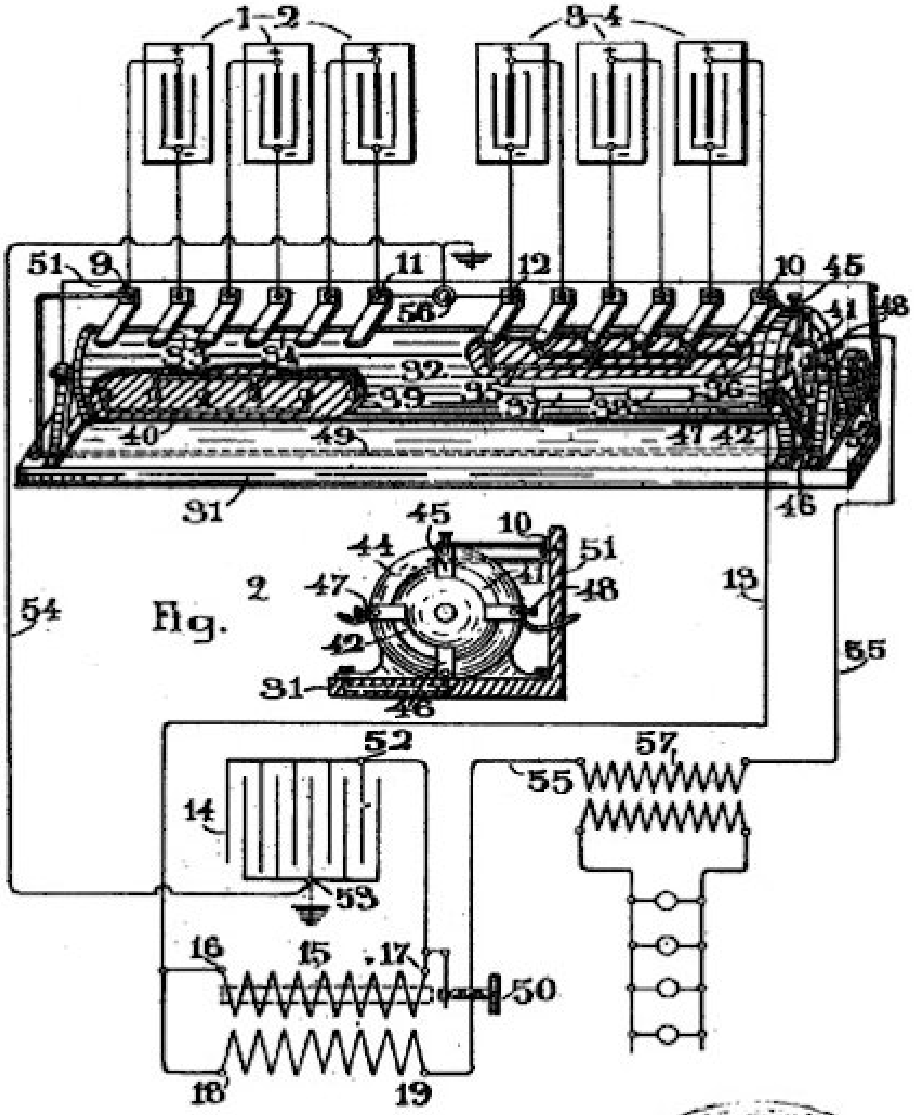

Fig. 2

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Appendix #4

Report on Visit to John Bedini

September 3, 1984

Written by Eike Mueller

EM/409031

Report on

Visit to John Bedini

With Comments by Tom Bearden

And Additional Experiments by Eike Mueller

3 September 1984

By: Eike Mueller

FOREWORD

Following an invitation by John Bedini, I went with him to Los Angeles immediately after the Colorado Springs Tesla Symposium on 10-12 August 1984. We had two days together to work on the Kromrey Converter and the Tesla Switching Device.

One thing came out very clearly: every time when we locked into the "free energy" all commonly known physical laws are no longer valid. The things happening react directly opposite to what one would expect. Specifically the more we loaded a specific circuit, the more output energy we gained, while using a constant input energy level. I will come back to this effect later, when I describe the experiments in more details.

At this point I want to take the opportunity and thank John Bedini and his lovely wife for their hospitality and assistance. It takes persons like John to get the "free energy" rolling. Without his publication [1] of the detailed plans for his free energy device, we would definitely not have seen the free energy devices demonstrated during the Tesla Symposium.

Also many thanks to Tom Bearden, who took his time and explained the results of the tests performed on 13-14 August 1984. His comments are contained in the concluding chapter of this report.

Kromrey Converter

John Bedini found that the material generally available concerning Kromrey's Converter had been altered. Rebuilding the Kromrey Converter from the patent papers ended up in a non-functioning device. Bedini found the necessary modifications which made this machine perform.

Our first goal was to determine the converter's efficiency. We found this to be quite difficult as the efficiency changes with the load applied.

FIGURE K-1 shows the first setup we used. We drove the Kromrey Converter from a 12 V motorcycle battery. We connected at the output of the converter a condenser and and a rectifier bridge in parallel. The rectified current was then put back into the motorcycle battery. To detect any current flow, we connect into the positive line a 12 V light bulb.

The result of this test was that the light bulb was lit up. However, after 15 minutes the battery voltage had dropped from 11.05 V to 9.10 V. The speed of the converter was stable at 1020 rpm.

---

[1] "Bedini's Free Energy Generator" by John Bedini, Tesla Book Company, Millbrae, California 1984

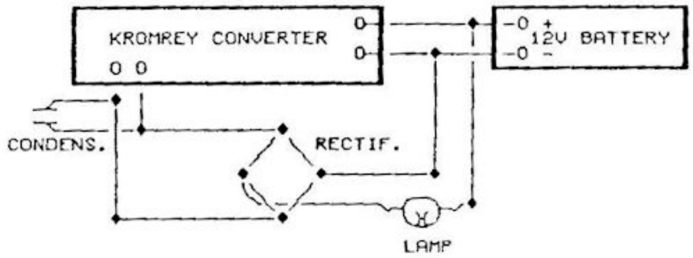
BEDINI, MUELLER 13 AUGUST 84 TEST # 1

KROMREY DEVICE

FIGURE K-1

KROMREY CONVERTER

TEST SETUP



SPEED OF CONVERTER: 17 RPS.

VOLTAGE AT BEGINNING: 11.05 V AFTER 15 MINUTES: 9.10 V

In the next test we introduced a seperate battery (BATTERY #2) for charging from the converter.

We recharged the battery #2 from 12.30 V to 12.40 V within 4 minutes, and we measured a current into battery #2 of 0.8 amperes.

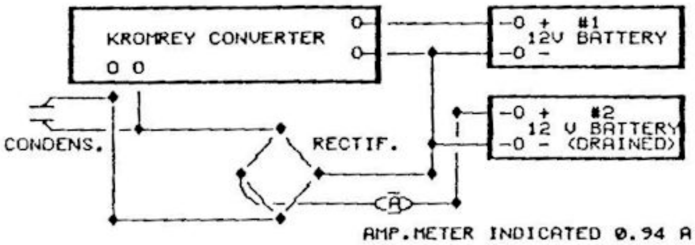
BEDINI, MUELLER 13 AUGUST 84 TEST # 2

KROMREY DEVICE

FIGURE K-2

KROMREY CONVERTER

SETUP 2

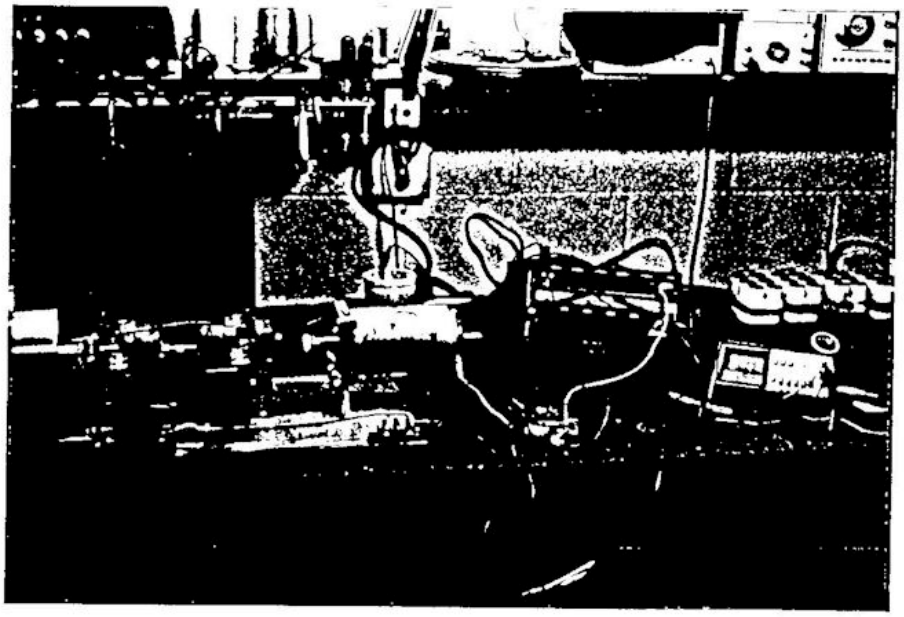


AMP.METER INDICATED 0.94 A

CHARGING OF BATTERY #2 VIA KROMREY CONVERTER AND BATTERY #1

VOLTAGE BATT. #2: 12.35 V, AND AFTER 4 MINUTES: 12.40 V

PICTURE C-1.1 shows the second test setup. On the left side is the Kromrey Converter, powered by an electric motor (center). Battery #2 is the battery in the front (center right) and battery #1 is the one behind it. The voltmeter shows the voltage of battery #2. The 12 V light bulb is on the table in front of battery #2.



PICTURE C-1.1

KROMREY CONVERTER

SECOND TEST SETUP

Because the Kromrey Converter turned too slow on one 12 V battery, we decided to drive the Converter using 24 V via two 12 V batteries, connected in series. PICTURE C-1.2 shows this setup.

PICTURE C-1.2

Next we wanted to find a correlation between the normal charging of battery #2 using a commercial battery charger, and charging this same battery with the Kromrey Converter. We drained the battery #2 to 8 V, connected it to the Kromrey Converter, and after reaching 11.51 V, we measured the time it took to charge the battery from this voltage level of 11.51 V to 12.45 V. We reached this voltage (12.45 V) after 11 minutes. The indicated current into the battery was 0.94 A.

We then repeated these steps using the commercial battery charger. Because we ran out of time after nearly 2 hours, we disconnected the battery from the charger. The battery voltage had reached 12.41 V. The measurement is depicted in FIGURE K-3.

BEDINI, MUELLER 13 AUGUST 84 TEST # 3

KROMREY DEVICE

COMPARISON MEASUREMENT USING A CONVENTIONAL BATTERY CHARGER

FIGURE K-3

BATTERY #2 VOLTAGE: 11.51 V

AFTER 119 MINUTES: 12.41 V

CHARGING CURRENT AT BEGINNING: 0.60 A; AT THE END: 0.37 A

NOTE: WE DID NOT REACH 12.45 V EVEN AFTER 2 HOURS.

We wanted to find the correction factor for the Kromrey Converter by comparing the same effect, i.e. the charging of the same battery from one specific voltage to another specific voltage. The calculation of this factor is shown in FIGURE K-4. This correction factor C_K was determined by dividing the area Y (amperes over time, for charging with the commercial battery charger) through area X (amperes over time, Kromrey).

BEDINI, MUELLER 13 AUGUST 84 TESTS # 2 + 3

FIGURE K-4

KROMREY DEVICE

DETERMINATION OF CORRECTION FACTOR

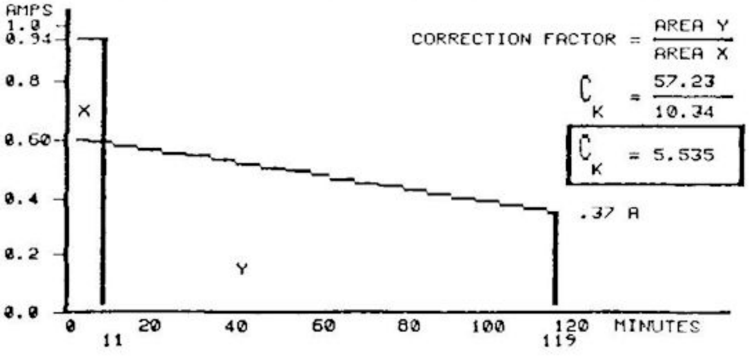


TABLE K-1 shows the combined test results. Because we detected an increase in the speed of the Kromrey Converter as well as a decrease in the input energy when we increased the output load, we decided to measure the input energy and speed when the output was shorted. Again, the input energy dropped and the speed increased.

MEASUREMENT	NO LOAD	LOADED WITH BATTERY	SHORTED	CORRECTED FACT. 5.535
- INPUT VOLTAGE	25.30	25.00	24.90	
- INPUT CURRENT	3.90	3.00	2.20	
WATTS IN	98.67	75.00	54.78	
- SPEED IN REV/SECOND	40.00	65.00	73.00	
- OUTPUT VOLTAGE (DC)	48.00	10.80	N/A	
- OUTPUT CURRENT	N/A	0.95	1.05	
WATTS OUT	N/A	10.26	N/A	56.78
WATTS IN/OUT		7.31		1.32

TABLE K-1

Using the earlier determined correction factor of 5.535 we calculated the energy we put into the battery to 56.78 Watts (from 10.26 * 5.535). Looking at TABLE K-1 we see that it takes only 54.78 Watts to run the Kromrey Converter when the output is shorted. This result led us to continue with these tests and load the converter output even more. The results of these tests can be seen in TABLE K-2 on the next page.

Here again, we detected that we will get a higher efficiency of the total device, the more we load down the output side. This effect is totally contradictory to the conventional laws of physics.

MEASUREMENT	NO LOAD	LOADED WITH LAMP & BATT.	LOADED WITH RESISTOR 13.5 OHM	LOADED WITH RESISTOR 0.63 OHM
- INPUT VOLTAGE	25.40	25.30	20.00	21.90
- INPUT CURRENT	3.90	3.90	3.39	2.30
WATTS IN	99.06	98.67	67.80	50.37
- OUTPUT VOLTAGE (DC)	48.00	28.00	50.00	20.00
- OUTPUT CURRENT	N/A	0.75		
- RESISTANCE (OHM)			13.50	0.63
WATTS OUT	N/A	21.00	185.19	634.92
WATTS OUT (CORRECTED)		116.24		
WATTS IN/OUT		0.85	0.37	0.08

TABLE K-2

We used the Kromrey correction factor for the first case, when we had connected the battery to the converter output. We did not use this factor in both other cases when we used resistors in the output circuit.

These above test results show that the efficiency of the Kromrey Converter is well above 100%.

The Tesla Switch

We used as a starting point for our experiments, the switching device John Bedini had built for the Tesla Symposium (FIGURE T-1). Our goal was to upgrade this switching device for ordinary car or motorcycle batteries.

To get a better understanding of this system, we first built only one half of the circuit. FIGURE T-2 shows our first arrangement.

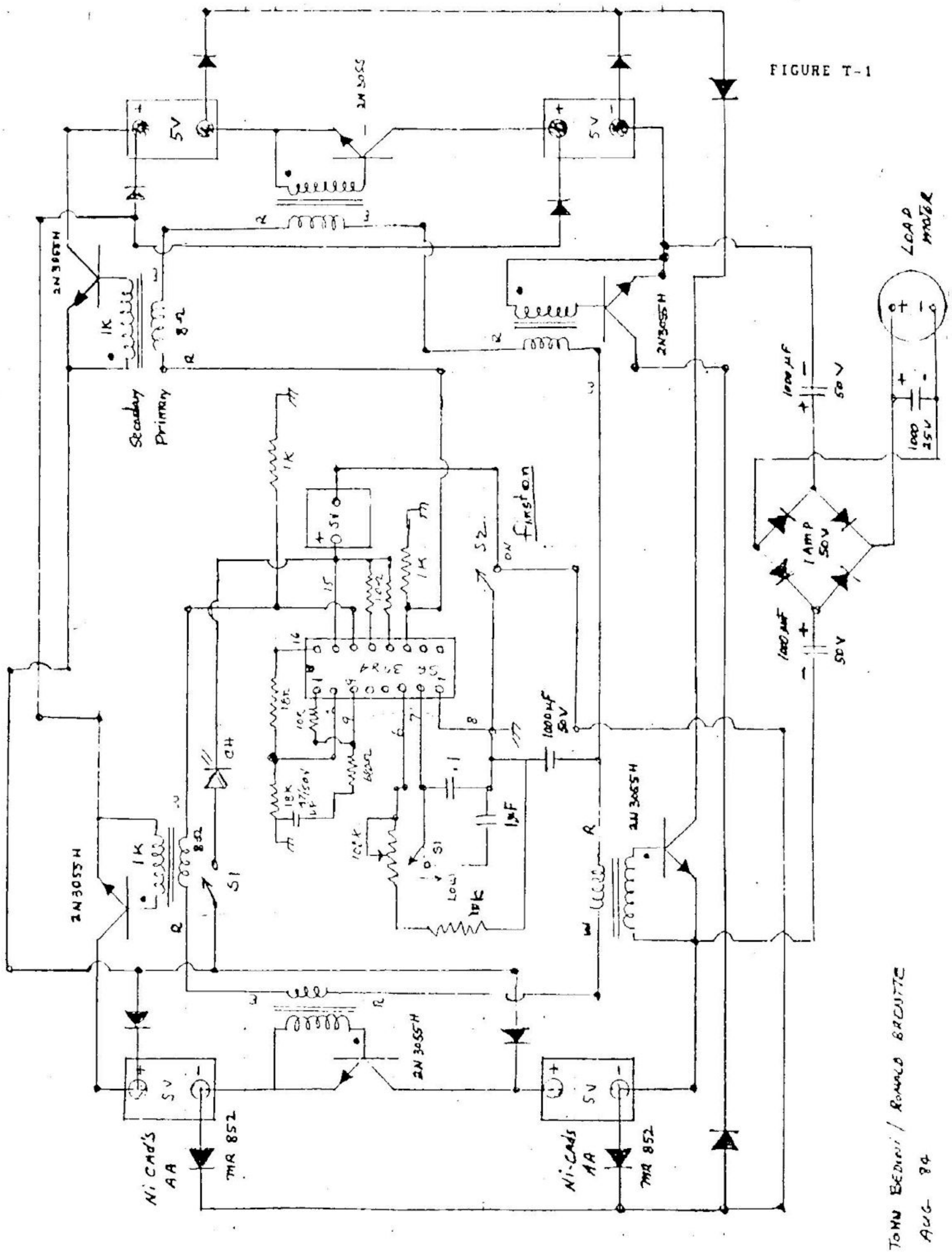

2N3055
2N3055H
5V
+
-
R
3
1K
8Ω
Secondary
Primary
1K
5V
15
16
10Ω
1K
S2
ON
First on
SG 3524
18K
10K
9
680Ω
6
7
8
1000µF 50V
.1
1µF
18K
47/50V
10K
S1
LOW
10K
CH
S1
Ni Cad's AA
MR 852
Ni-Cads AA
LOAD MOTOR
1000µF 50V
1 AMP 50V
1000 25V
JOHN BEDINI / RONALD BROSTE
AUG 84

FIGURE T-1

BEDINI, MUELLER 13 AUGUST 84 TEST # 11A

TESLA SWITCH

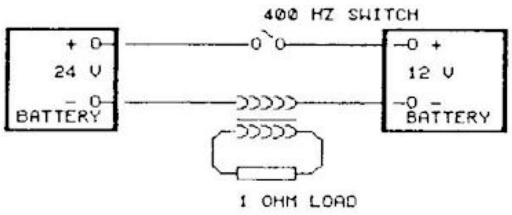


FIGURE T-2

TO RAISE THE VOLTAGE FROM 11.51 V TO 12.45 V TOOK 5 SEC.
COMPARE THIS RESULT WITH TESTS # 3 AND 5. FIG. K-4
NOTE: 1 OHM RESISTOR REMAINED COLD AFTER 15 MIN. RUN TIME.

Using the setup shown in **FIGURE T-3**, we performed the same kind of test we did earlier, using the Kromrey Converter. This time we used a 12 V battery with one dead cell as if it were a 10 Volt battery (dead cell not in the loop). The supplying battery was a freshly charged 12 V battery.

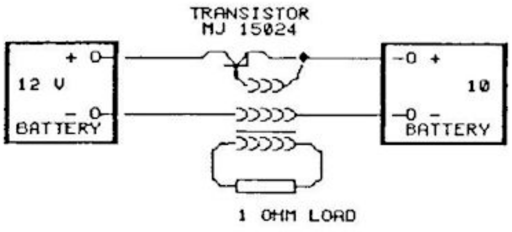
In the first step we drained the 10 V battery. When we connected this battery to the conventional battery charger it showed a voltage of 1.7 Volts. After 12 minutes 20 seconds we had reached a voltage level of 10.24 Volts.

Again, we drained the battery and then connected it to the Tesla Switch. After 1 minute and 24 seconds we had reached 10.24 Volts. We detected that the temperature of the battery was higher than it was before, when we had used the conventional battery charger.

BEDINI, MUELLER 13 AUGUST 84 TEST # 11B

TESLA SWITCH

FIGURE T-3



TO RAISE THE VOLTAGE FROM 1.7 V TO 10.24 V TOOK 1 MIN 5 SEC.
NOTE: 1 OHM RESISTOR REMAINED COLD AFTER 15 MIN. RUN TIME.

Because we had already learned that the efficiency will go up the more we load the circuit (see TABLE K-2), we decided to load this Tesla circuit also. We modified our test setup slightly by introducing amperemeters and two light bulbs. A 110 V, 40 W bulb was used on the secondary side of the transformer, and a 12 V, 280 W quartz lamp was connected in parallel with the 10 V battery. FIGURE T-4 shows the arrangement and the currents we measured. Again, we found that when we connected the quartz lamp, the 110 V light instantenuously became brighter.

BEDINI; MUELLER 13 AUGUST 84 TEST # 12

TESLA SWITCH

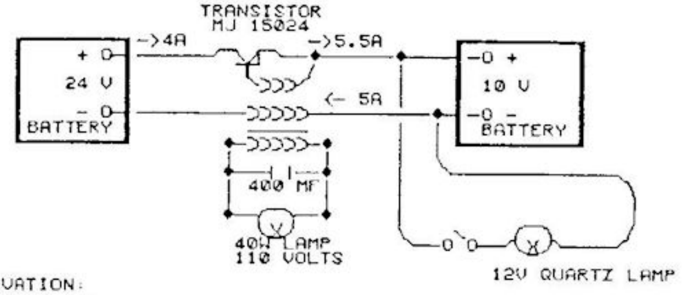
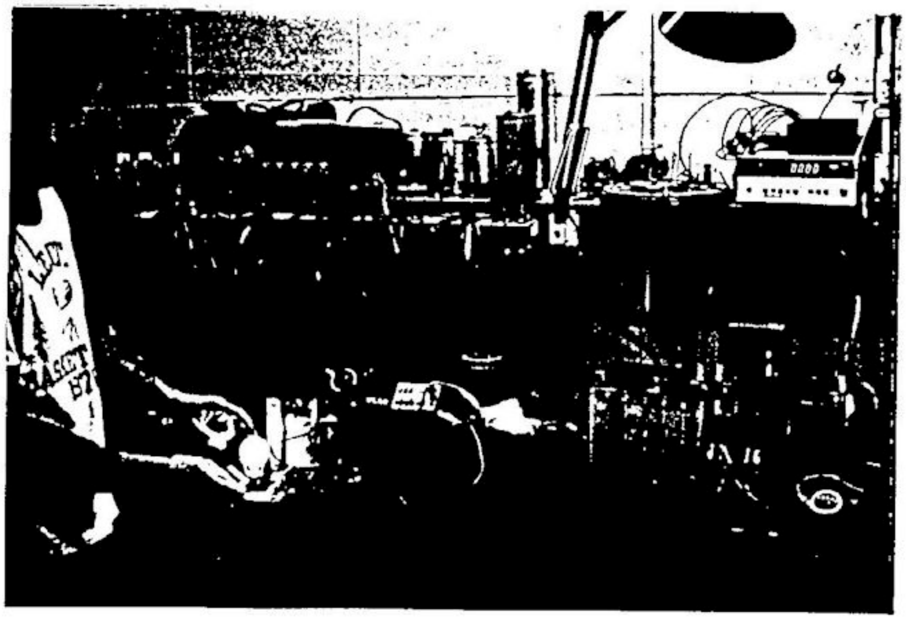


FIGURE T-4

OBSERVATION:

WHEN 12V QUARTZ LAMP WAS ADDED, THE 40W LAMP BECAME BRIGHTER

PICTURE C-2.1 shows this experiment. The quartz lamp is on top of the 10 V battery and the 110 V light bulb is in front of the transformer.



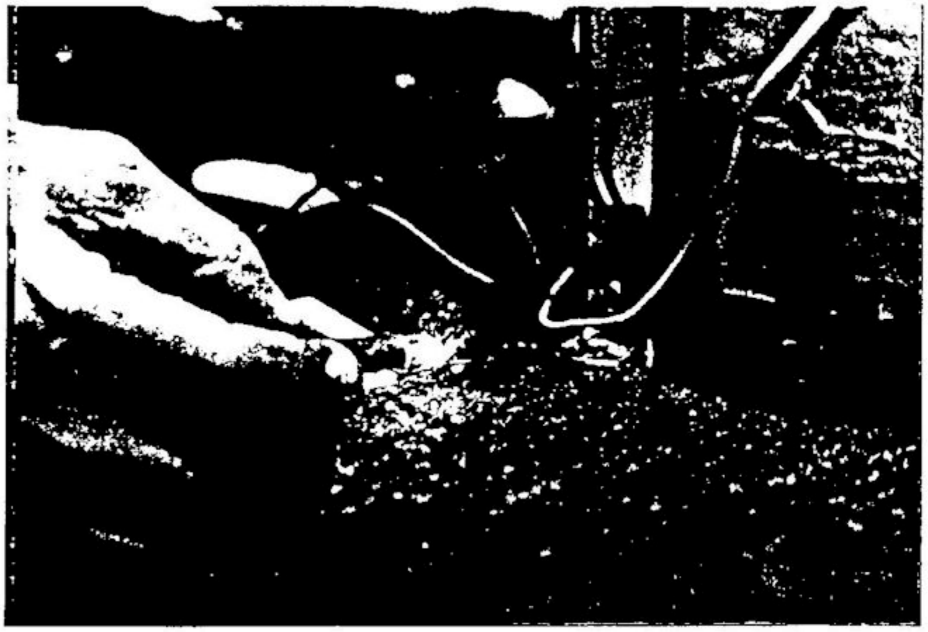
PICTURE C-2.1

When we compare all the measured values we get the following table:

CURRENT FLOW FROM THE 24 V BATTERY:	4.0 A	AT 24.0 V	--->	96 WATTS
CURRENT FLOW INTO 10 V BATTERY:	5.5 A	AT 10.6 V	--->	58 WATTS
INTO QUARTZ LAMP:	30.0 A	AT 9.0 V	--->	270 WATTS
40 WATTS 110 V LIGHT BULB:			--->	40 WATTS

WATTS IN/OUT = 96/368 = 0.26

Every time when we disconnected and connected the 110 V light bulb in the setup as shown in FIGURE T-4 we saw a spark about a half-inch long. The light of this spark was noticably different from the light of sparks observed when experimenting with high voltages. PICTURE C-3 shows such a spark. We discovered that in addition to X-rays we were also generating scalar waves. These were detected using a scalar wave detector built by John Bedini, which was based on a plan by Tom Bearden.



PICTURE C-3

Simplified Diagrams

At the end of this report I now show two simplified switching diagrams. These have been modified from the original diagram of Mr. Ronald Brentte which was given to John Bedini. Ken Moore and I updated the original diagram to make it more understandable to the layman.

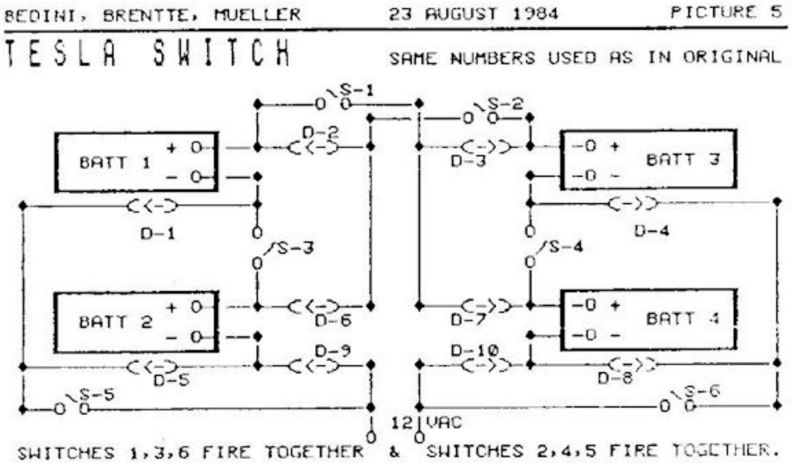


FIGURE T-5

Original Diagram of Mr. Ronald Brentte

FIGURE T-6 shows how a circuit can work using three double-pole relay switches driven by a pulse rate generator (Ken Moore).

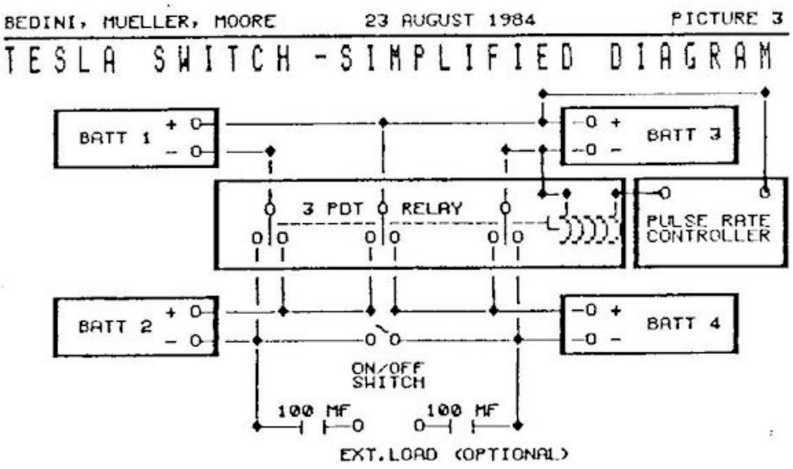


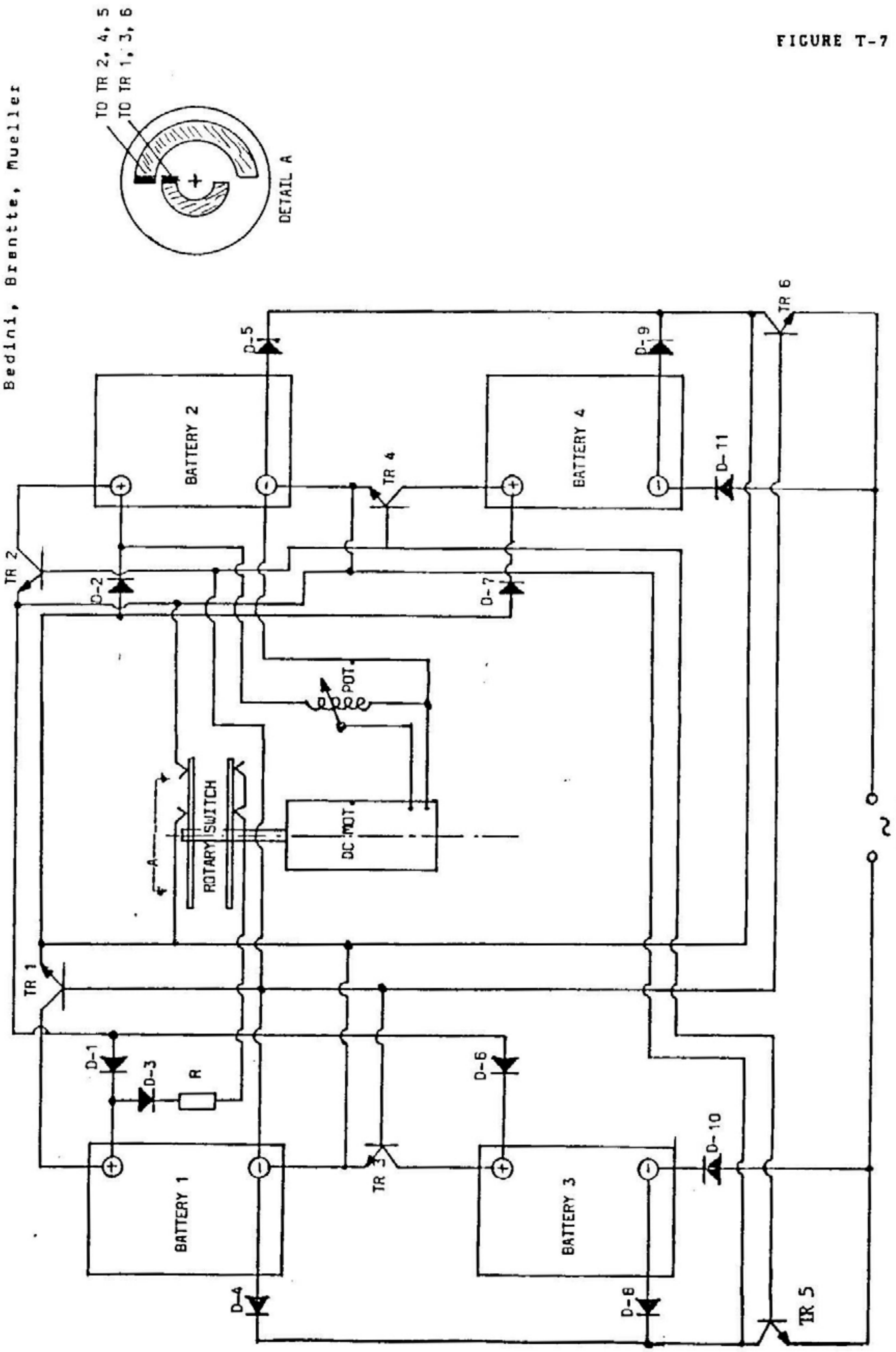
FIGURE T-6

FIGURE T-7 shows the circuit diagram for a setup using MJ 15024 power transistors driven by a rotary switch device.

FIGURE T-7

TESLA SWITCHING DEVICE

Bedini, Brantte, Mueller



COMMENTS BY TOM BEARDEN

- The Observation/Detection Process -

From the standpoint of modern physics, the "universe" we detect, measure, and see is always the "output" of an interaction between the detector/observer and "that unobserved reality" that is really there before the interaction. The "basic reality, before observation/detection" is comprised of something referred to as "action," having the units of angular momentum. That is, unobserved reality is composed of "energy multiplied by time," or "momentum multiplied by length," or the product of two other "locked together" (canonical) variables.

The best way to visualize a photon -- the basic electromagnetic quantum -- is to think of it as "a little piece of energy welded to a little piece of time," with no seam in the middle. In other words, the photon is a sort of "fusion of energy and time, without separation in any fashion." When we speak of "energy," ultimately we speak of photon exchange, whether the photons are "virtual" (smaller than can be individually detected) or observable (large enough to be individually detected.

Even with the macroscopic mechanical interactions, ultimately the forces are generated not by colliding objects but by exchange of virtual photons, in the view of modern quantum physics.

At any rate, when we make a "detection," the smallest amount of change involved in the unobservable universe is one "quantum" of action. However, we do not actually detect a whole quantum: instead we detect one piece of the quantum and lose the other piece. In other words, if we detect all the little piece of energy in the quantum, we lose all the little piece of time. If we detect a little piece of momentum, we lose all the little piece of length. The point is, one can imagine that we "split" or "fission" the quantum when we "detect", and we only detect one part of it. FIGURE 1 shows the operation of the detection process. Specifically, according to quantum mechanics we can never directly detect or observe the piece of "time" at all. Time is not observable, even in principle, in quantum mechanics.

In my first crude paper along these lines [1], I pointed out that quanta do not superpose; instead, a single quantum change occurs at a time, and a single detection occurs at a time. In conceptually modeling the fundamental detector itself, it was necessary to utilize a "fusion" process on the fragments of the quantum resulting from the fission/detection process. In other words, one has to clear out the residue before another "fragmenting" can occur. The way this happens is that the two pieces are fused together, back into a full quantum, disappearing into the basic action continuum.

Thus the passage through time of a body occurs in little time jumps. (FIGURE 2). And each little piece of time helping to make an individual jump is removed before the next jump occurs. That is, our march through time is not at all through a continuous time dimension as

Minkowski spacetime and relativity model it. Instead, we march through time like a peculiar sewing machine, one stitch at a time, and each stitch made is removed before the next one is made. This explains precisely why we cannot "see through time" as we see along the physical dimension. The time dimension is continually fragmented and destroyed.

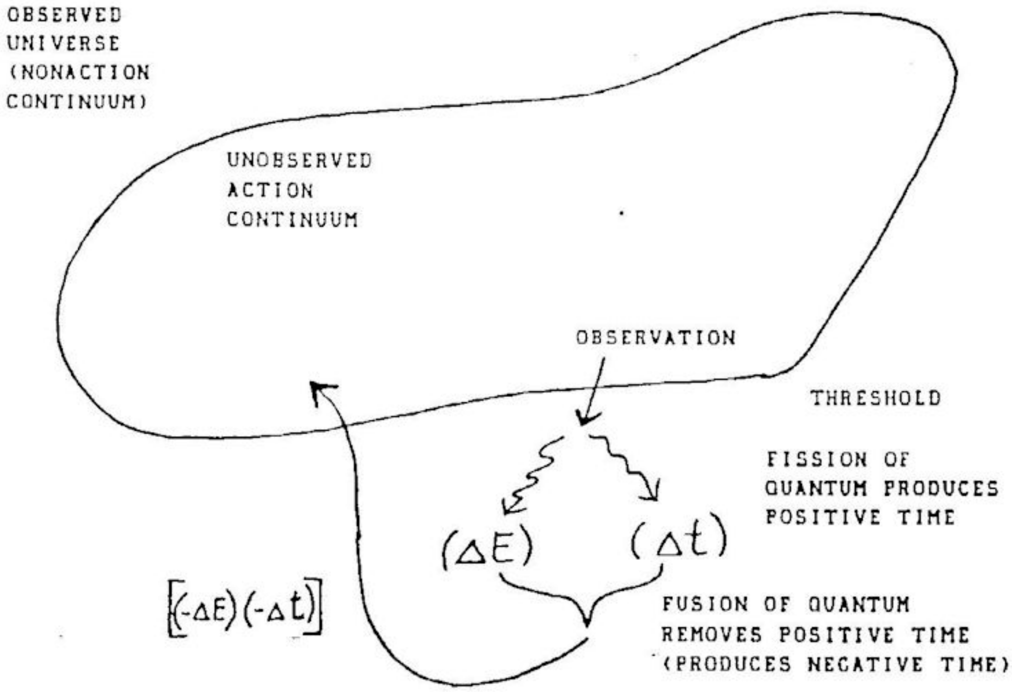

OBSERVED UNIVERSE (NONACTION CONTINUUM)
UNOBSERVED ACTION CONTINUUM
OBSERVATION
THRESHOLD
FISSION OF QUANTUM PRODUCES POSITIVE TIME
(ΔE)
(Δt)
[(-ΔE)(-Δt)]
FUSION OF QUANTUM REMOVES POSITIVE TIME (PRODUCES NEGATIVE TIME)

FIGURE 1. The Operation of Physical Detection at the Quantum Level.

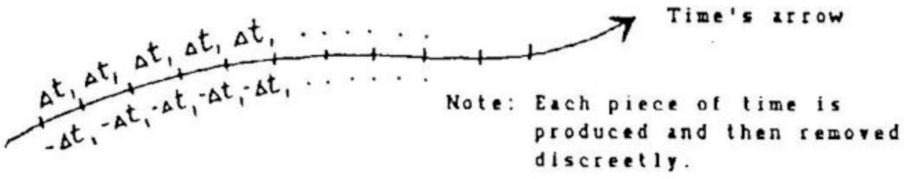

Time's arrow
Δt, Δt, Δt, Δt, Δt, ...
-Δt, -Δt, -Δt, -Δt, -Δt, ...
Note: Each piece of time is produced and then removed discreetly.

FIGURE 2. Passage of Object Through Time Occurs in Discrete Jumps

FIGURES 1 and 2 show the situation. Note that we can consider the "successive ripping out of time stitches" as the negative stream of time.

In this model, everything exists in both positive and negative time streams that usually are balanced. In this fashion, a completely new definition of mass was obtained, Newton's laws of motion (relativistic form) were derived, and the square law of gravitation was derived, albeit crudely. [2]

Now notice that, when an action quantum is spilt into conceivable energy and time, it may be split in two ways: a) it can be split into positive pieces of energy and positive pieces of time, or b) it can be split into a negative piece of energy and an negative piece of time. FIGURE 3 shows these possibilities of splitting. Note that, if we consider both the fission and fusion processes, both splits actually occur, depending upon which time stream one chooses to observe from.

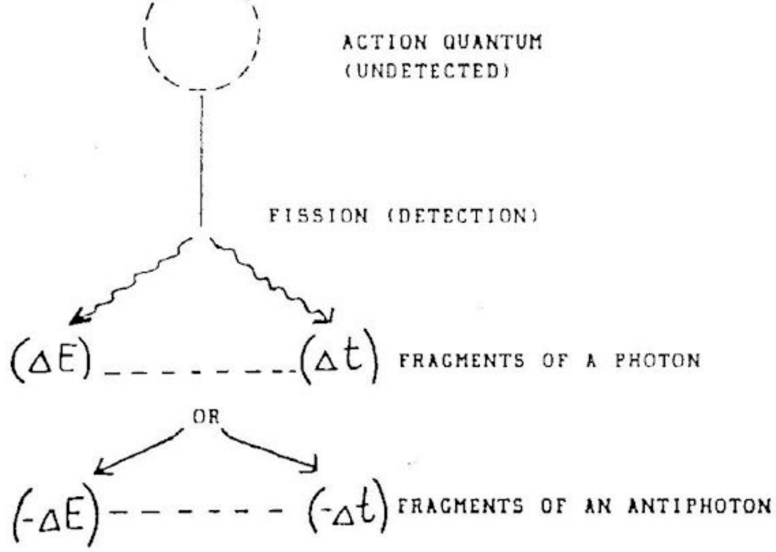


FIGURE 3. Two Possibilities of Action Quantum Fissioning

This is most interesting. We now have a concept whereby each object is passing through both the negative time flow and the positive time flow in an interweaved manner; to the microscopic observer, this appears to be simultaneously.

So an object may be said to possess both positive and negative energy, simultaneously, as a first order approximation. It possesses positive energy in positive time, and negative energies in negative time. In all normal processes, we have considered and developed only positive time processes. However, we point out that negative time operation is well-known in modern physics. Feynman diagrams involve extensive negative time travel. Originally Dirac did not predict the positron as a positive particle travelling forwards in positive time. Instead, he predicted a negative particle (traveling in negative time, in our

view), which we could only observe (with positive time instruments!) as a positive particle traveling forwards in time. In the view of modern physics, real particles already travel backwards in time sometimes.

But if we can actually produce some extra negative time in a device which normally is observed only to produce positive time, we shall obtain a reversal of entropy. Systems which tend to disorder in positive time, tend to order in negative time. Such an effect (production of negative time) involves the concomitant production of negative energy. However, negative electromagnetic energy will still run motors and burn light bulbs. The photon, you see, is its own antiparticle: and an antiphoton is just observed as another photon.

We will choose to regard an antiphoton as consisting of negative energy and negative time, and producing these two fragments if detected in the laboratory frame. The production of antiphotons and negative time will yield negentropy and additional or "free" negative energy, appearing to us to violate the ordinary "conservation of energy" law. This is no problem; production of unbalanced time streams, and hence the appearance of negative energy and negative time, is itself a "curved spacetime" phenomenon. Any system exhibiting this effect is existing in a locally curved spacetime (FIGURE 4). That is, it is now a general relativistic system, and energy need not locally be conserved. The system can appear to contain either a source or a sink, depending upon the individual system's functioning, to an external laboratory observer. We will return to this effect shortly.

Note the two time lines are of equal length. The negentropy device is producing negative energy and negative time, with respect to the lab observer.

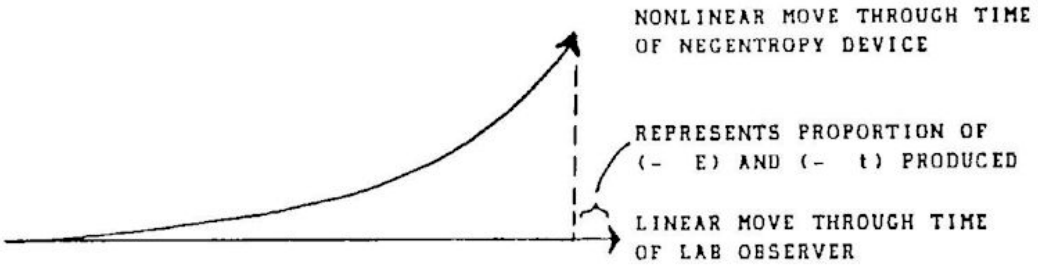

NONLINEAR MOVE THROUGH TIME OF NEGENTROPY DEVICE
REPRESENTS PROPORTION OF (- E) AND (- t) PRODUCED
LINEAR MOVE THROUGH TIME OF LAB OBSERVER

FIGURE 4. Production of Negentropy by Local Curvature of Spacetime Vacuum.

Three Kinds Of Electromagnetics

There are actually three types of electromagnetics (TABLE 1), as I pointed out in my paper [3] to the IEEE Colorado Springs Tesla Centennial Symposium on 11 August 1984:

a) The ordinary kind of EM, described in classical electromagnetic theory. In classical EM theory, the vector force fields are considered primary and causative, and the potentials are considered to be only mathematical figments. In a region where the force fields are zero, classical EM theory assumes that all the electromagnetic effects cease.

b) Quantum mechanics, which holds quite a different view of EM. In QM theory the potentials are considered to be real and fundamental, and the EM force fields are merely created from them by differentiation. That is, QM considers the force fields such as E and B to be derived effects, not fundamental causes. Further, when these derived force fields are zero, this only means that the gradients of the potentials are horizontal and hence "zero vectors." The potentials are still there, however, and their interference in a region of zero EM force fields can and does still cause effects. Thus, when classical EM effects reduce to zero, QM EM effects can still exist due to the potentials. In addition to violating classical EM theory, this also violates classical mechanics. It is true and experimentally proven nonetheless. [4] [5]

c) An extension to the EM view of quantum mechanics, which I have named "scalar electromagnetics." The view of a potential by QM is essentially that it is composed of randomly fluctuating little virtual flux vectors, each representing a moving virtual particle and hence a moving virtual force. That is, QM fundamentally assumes that the virtual vector substructure comprising a potential stress of spacetime is totally statistical and sums to zero. My own contribution, arrived at by noting the work of many unorthodox researchers, is to point out that the virtual substructure need not to be random at all. We can simply form EM force field vector zeros by opposing or summing ordinary E and B vectors, for instance, to a zero vector. In this case, the sum of the absolute values of their magnitudes represents an artificial potential, an artificial stress in spacetime, but one that now has a rigorously deterministic substructure. This represents a deterministic ordering placed into the virtual state (inside the zero vector, in its substructure). We have therefore violated one of the fundamental assumptions of quantum mechanics. We have deliberately ordered and formed the stress of spacetime itself. In other words, we have accomplished general relativistic warping or curving of spacetime as we deliberately chose, and partially ordered the otherwise statistical disorder of the virtual-flux vacuum-ether. The third kind of electromagnetics allows us to transcend many of the limitations of classical EM and of quantum mechanics.

TABLE 1 THREE KINDS OF ELECTROMAGNETICS

CLASSICAL

- -> POTENTIALS JUST MATHEMATICAL CONVENIENCES
- -> ACTIONS CAUSED BY NONZERO FORCE FIELDS
- -> NO ACTION WHEN FORCE FIELDS ZERO

QUANTUM MECHANICS

- -> POTENTIAL REAL
- -> STATISTICAL SUBSTRUCTURE
- -> FORCE FIELDS BY DIFFERENTIATIONS
- -> ACTIONS WHEN FORCE FIELDS ZERO

ARTIFICIAL POTENTIALS

- -> POTENTIALS REAL
- -> FORCE FIELDS EXTERNALLY ZEROED, INTERNALLY ACTIVE
- -> ZEROS INDIVIDUALLY DIFFER
- -> SCALAR INTERFEROMETRY
- -> SCALAR RESONANCE

TABLE 2 shows the specific characteristic features of each of the three kind of electromagnetics. The first two EM's are already proven; the third follows by simple summation of ordinary force field vectors to zero, to produce artificial potentials.

Note what an astounding change this simple vector summation-to-zero, to make an artificial potential, represents to physics. In deliberately forming order in what was previously vacuum disorder, we have accomplished -- simply and directly -- the production of negentropy. We have reduced disorder and increased order.

If so, we must inevitably have produced negative time and negative energy, as seen by the external, linear laboratory observer, as was shown in FIGURE 4.

TABLE 2 COMPARISON OF EM CONCEPTS

Theory Characteristic	Classical EM	Present linear Quantum Mechanics	Scalar EM (Artificial 0)
Vacuum spacetime	Linear no charge	Linear, Charged (virtual) statistically.	Nonlinear, Charged (virtual) with deterministic components.
virtual substructure	none (fluid equations)	yes statistical	yes, statistical deterministically weighted
force in vacuum?	cause yes	effect yes	effect no
zero force fields	no effect	Bohm-Aharonov effects	substructure effects engineerable
potentials	ficticious	real, primary statistical substructures	real, primary deterministic substructures
causative agent	force fields	potentials	potentials and infolded fields of substructures
charge	with mass	with mass	massless
relativistic effects due to	velocity	velocity interfering potentials	interfering potentials
hidden variables	no	statistical negligible	deterministic major role
vector theory applied to EM	okay	okay	requires revision
vacuum EM wave	transverse	transverse	longitudinal with swirls
energy/mass conservation	yes	yes	not necessary anenergy conserved
charge conservation	yes	yes	not necessarily
action at a distance	no	no, except Bohm-Aharonov	yes, scalar interferometer

TABLE 2 (continued) COMPARISON OF EM CONCEPTS

Theory Characteristic	Classical EM	Present linear Quantum Mechanics	Scalar EM (Artificial ϕ)
scalar (zero-vector) resonance	no	no	yes
inertia is electrical	no	no	yes
gravity is electrical	no	no	yes
mass is electrical	no	no	yes

Negative Time Effects

Eike Mueller's tests of John Bedini's free energy devices directly demonstrate the effects of the production of negative time. That is, the Bedini devices produce some negative time and negative energy, during any macroscopic interval in which they produce positive time and positive energy.

For example, in all three devices Bedini has built to date, a battery is used as an accumulator for the energy, whether it be positive energy or negative energy. By feeding back some "negative potential current" (or ϕ-dot) to the battery, the battery accumulates -- and charges up with -- negative timespace energy. The battery can furnish the extra negative energy to motors and light lights, with certain peculiarities to be mentioned shortly.

First, however, a most unusual effect occurs in the battery. Note that in modern theory the vacuum is considered to be filled with little "holes" or negative energy states, each normally filled by the electron. (FIGURE 5). This "sea of little negative energy electrons in holes" is called the Dirac sea, after the eminent scientist P.A.M. Dirac, who conceived the theory.

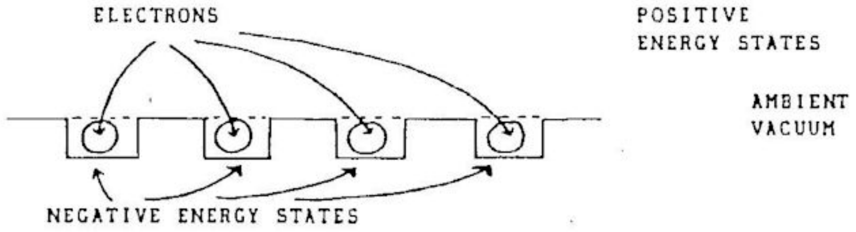


FIGURE 5. The Normally-Filled Dirac Sea

Now, in the negative time portion of the machine's operation, we shall consider that the Dirac sea is inverted. That is, the negative energy electrons will now "fall out of" the holes during the negative time portions, producing negative energy. This of course is real energy, and drives motors and lights. However, a battery which has been charging with negative energy has accumulated a pool of emptied holes in its Dirac sea (FIGURE 6). Everything seems normal, until we remove the battery from the negative-entropy device and hook it up to a normal battery charger. Now we find an amazing effect: the battery will at first "eat" or consume electricity, while the electrons in the charging current are filling the empty Dirac holes. During this filling time, the battery will not recharge to recover its voltage. After these Dirac holes have been filled again with electrons, the battery will start to charge up normally, and will contain normal, positive energy when charged (FIGURE 7).

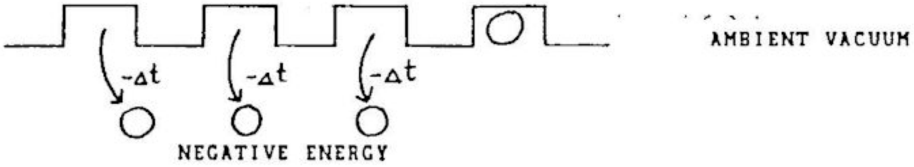


FIGURE 6. The Partially-Emptied Dirac Sea

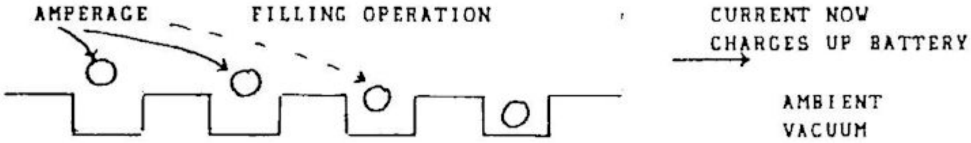


FIGURE 7. Filling The Dirac Sea Holes

On one test, a Bedini battery removed from the operating Kromrey-type device consumed electrical current for 110 minutes before the Dirac holes were filled and the battery started to charge normally.

At the Colorado Springs Tesla Centennial Symposium, the battery from Tom Watson's Bedini-type free-energy device was stolen -- probably by agents who know of the effect, and wanted to see if the battery exhibited the "Dirac fill time" effect. That is, they could absolutely ascertain whether or not his device was real, simply by testing the battery to see if it exhibited the effect.

On any free-energy device which is powered from a recharging battery, this is a positive test to ascertain whether the device is genuine or a fake.

Other negative time effects are evidenced by a motor running at least partially on negative energy. The way to understand these effects is to reverse in our minds what would happen to a normal motor running on positive energy and positive time.

For example, one may visualize a motor running at constant speed as containing some constant value of energy at any given time. If all the energy is positive and the time passing is positive, when one shorts the terminals one removes positive energy. The motor thus dies. On the other hand, if the motor contains a negative energy and negative time, shorting the terminals removes negative energy and negative time. This is equivalent to increasing negative energy in positive time. Therefore the laboratory observer will observe the motor to increase its speed when the terminals are shorted. Eike Mueller directly observes this effect in the Bedini device.

Similarly, if one adds additional loads to a negative energy/negative time motor, one is again removing negative energy and negative time, which is identical to adding negative energy in positive time. Thus again the motor increases its speed precisely as Eike Mueller's tests showed.

Additional negative time effects are exhibited. Utilization of negative energy produces IR^2 cooling instead of heating. Thus resistors and semiconductors run cold. The more load added, the more negative energy current drawn -- and devices get cooler, even though the lights get brighter and the motor runs faster. Also, to the negative energy/negative time operation, the frequency/temperature spectrum appears to be inverted. That is, instead of "heating up" through infrared, into visible, into ultraviolet, and into X-rays and gamma rays, the negative energy device exhibits "cooling down" from gammas to X-rays to visible to infrared. In this manner one finds that a simple low voltage (positive instrument measurement!) spark exhibits profoundly unusual effects: Its negative time/negative energy/"voltage" may be extremely high . The spark therefore may appear of extraordinary length for the (seemingly) low voltage indicated by positive-time instruments. In addition, the spark may be unusually rich in UV emission or X-ray emission. For uncontrolled very high-energy negentropy devices, even gamma emission may be observed from seemingly "low voltage" devices. The long-sought X-ray laser and gamma ray laser should be easily constructable along negative entropy device principles.

These are just some of the exciting effects that have become apparent in the negentropy devices built by John Bedini. Further, John has magnanimously released sufficient details so that other experimenters can produce working models of two of his devices. Tom Watson has already successfully replicated the first Bedini motor, and scaled it up into a much larger device. In addition, Eike Mueller himself has replicated a simplified version of Bedini's Tesla switch device.

We are on the threshold of a new science, a new world, and a new life, given to us by the pioneers such as Tesla, Moray, Bedini, and others.

Let us get on with it and put it to immediate use to power our cities, our homes, and our industries.

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ADDITIONAL TESTS BY EIKE MUELLER

30 August / 1 September 1984

In the first series of tests I used the rotary switch. The batteries were labeled as #1 and #2 (left side) and #3 and #4 (right side).

Here are the major events.

EVENT 1 Start at 12:25 pm, voltage measurements taken.

EVENT 2 At 12:45 pm voltage measurements taken.

EVENT 3 At 1:00 pm the 12V, 75W lamp replaced by a 110/10V transformer.

EVENT 4 At 1:15 pm voltage measurements taken.

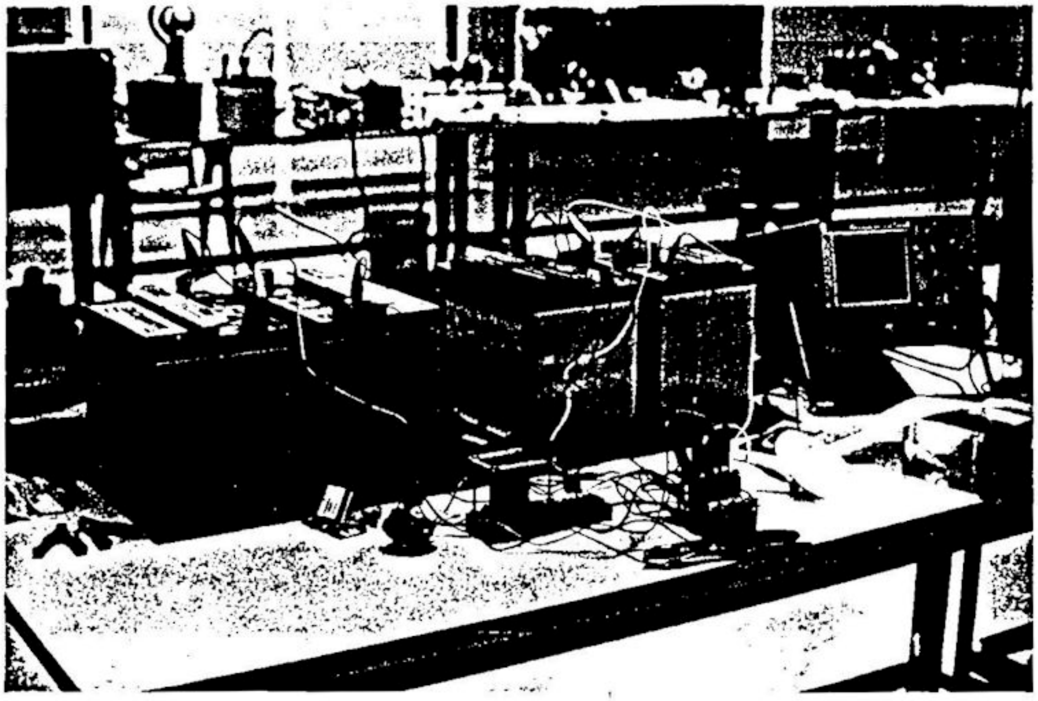
EVENT 5 At 1:30 pm test stopped, voltage measurments taken.

TABLE 1 shows the detailed voltage measurements during the conduct of this test.

TIME	12:25	12:45	1:00	1:15	1:30
EVENT	1	2	3	4	5
VOLTAGE					
BATT.#1	12.0	12.0	12.1	12.1	12.1
BATT.#2	11.9	11.9	12.2	12.2	12.2
BATT.#3	12.2	12.1	12.7	12.8	12.8
BATT.#4	12.2	12.2	12.7	12.7	12.8

TABLE 1 TESLA/BRENTTE/BEDINI SWITCHING DEVICE FIRST SERIES

PICTURE 1 shows the conduct of this test. The batteries were labeled from #1 to #4 from left to right. In the center the rotary switch, and to the left of it the potentiometer for its speed control (frequency control of circuit), can be seen. To the right of the rotary switch is the relay which switches the battery banks. To the right of the relay is the 12 V, 75 W quartz lamp which is connected to the negative terminals of batteries #2 and #4.



PICTURE 1 FIRST SETUP OF TESLA SWITCH EXPERIMENT

At 3:00 pm the Tesla switch was reconnected. This time the relay was driven by the timer which was built by Louis Pollaehn of COMTEC. FIGURE 1 shows the circuit diagram for this timing device and PICTURE 2 shows the solid state timing device in operation.

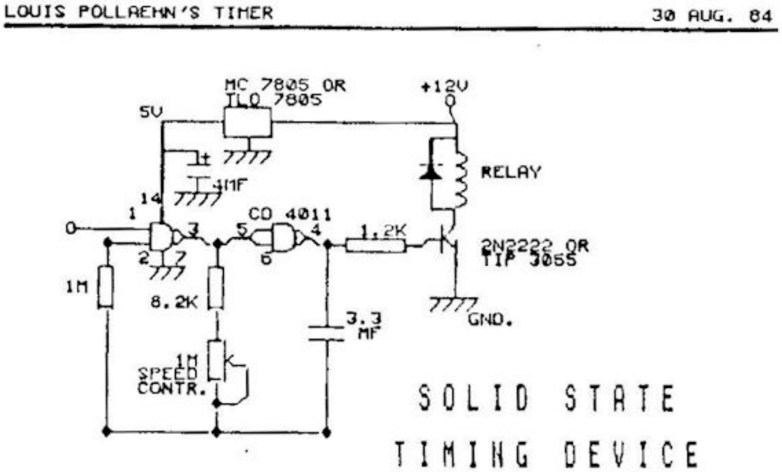
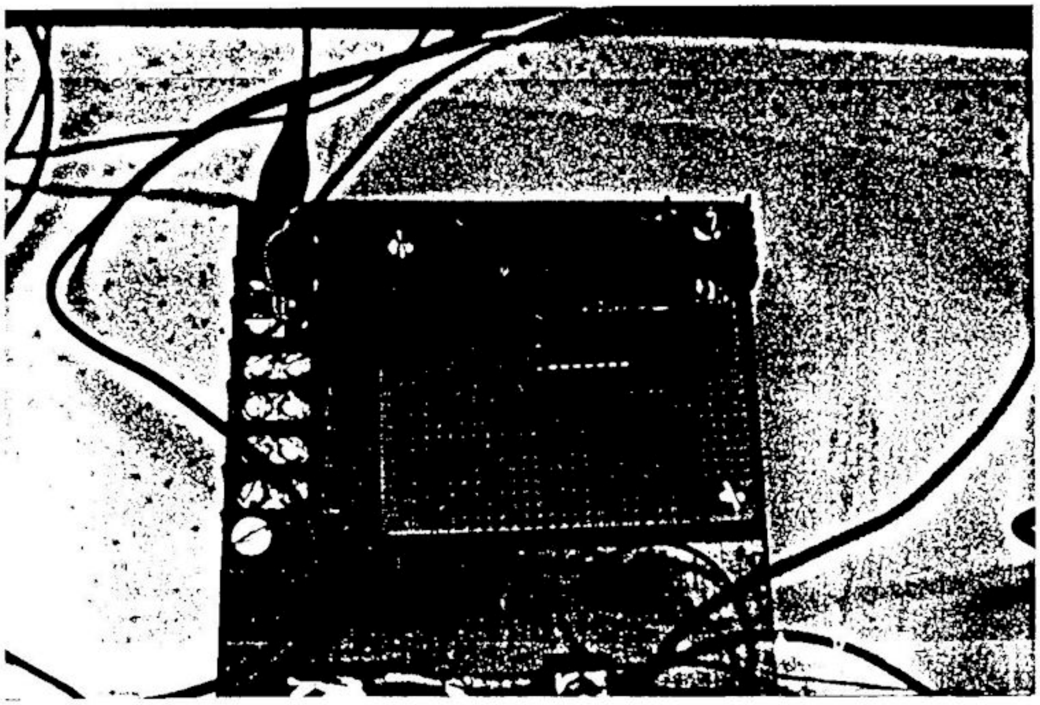


FIGURE 1 CIRCUIT DIAGRAM OF TIMING DEVICE BY LOUIS POLLAEHN



PICTURE 2 THE SOLID STATE TIMING DEVICE IN OPERATION

Test history:

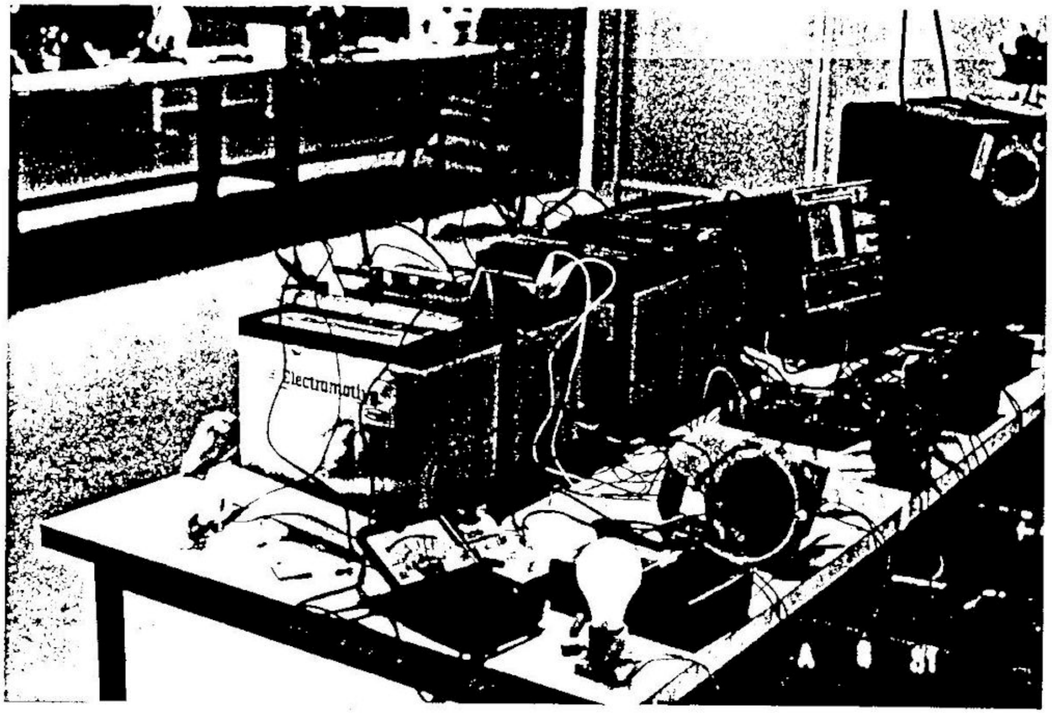
EVENT A At 3:10 pm test started, load was a 110/10 V transformer between the two negative terminals of batteries #2 and #4. The secondary side the transformer was connected to two 40W, 110V light bulbs in parallel.

EVENT B At 4:00 pm voltage measurements taken

EVENT C At 4:30 pm a small 110 V fan was added in parallel to the two 110 V light bulbs.

EVENT D At 5:40 pm a 12 V, 75 W quartz lamp was connected to battery #1.

EVENT E At 6:00 pm voltage measurements taken. PICTURE 3 shows this setup. At left is the quartz lamp connected to battery #1. In the center foreground are the two incandescent lamps. To the right of the lamps is the 110 VAC fan. Behind the fan and out of sight is the relay. Next is the 110/10 V transformer, hooked up to the two negative terminals of batteries #2 and #4. The solid state timing device is located between the transformer and battery #4



PICTURE 3 **Tesla/Brentte/Bedini** Switching device loaded with two 110V light bulbs, 110V fan and a 12V 75W quartz lamp.

EVENT F At 6:30 pm voltage measurements taken

EVENT G At 7:00 pm one 110 V light bulb disconnected.

EVENT H At 7:25 pm the same 110 V light bulb connected back into the circuit.

TABLE 2 shows the results of this test.

TIME	3:10	4:00	4:30	5:40	6:00	6:30	7:00	7:25
EVENT	[illegible]	B	C	D	E	F	G	H
VOLTAGE								
BATT #1	12.0	12.[illegible]	12.[illegible]	12.3	12.2	[illegible]	13.0	12.0
BATT #2	12.1	12.5	12.5	12.4	12.2	12.1	12.1	12.1
BATT #3	[illegible]	12	12.[illegible]	12.5	12.4	12.5	12.4	12.4
BATT #4	[illegible].3	12.[illegible]	12.[illegible]	12.5	12.6	12.5	12.4	12.[illegible]

TABLE 2 TESLA BRENTTE/BEDINI SWITCHING DEVICE SECOND SERIES

TABLE 3 shows the continuation of above measurements

Here again first the events:

EVENT I 8:30 pm voltage measurements taken.

EVENT J 9:15 pm voltage measurements taken.

EVENT K 10:30 pm voltage measurements taken.

EVENT L 11:05 pm voltage measurements taken.

EVENT M 11:30 pm voltage measurements taken.

EVENT N 10:30 am (1 Sep) discovery after unit has been operated during all night that both 110 V lamps were out and that one wire was broken due to overheating. Voltage measurements taken.

EVENT O 11:30 am voltage measurements taken.

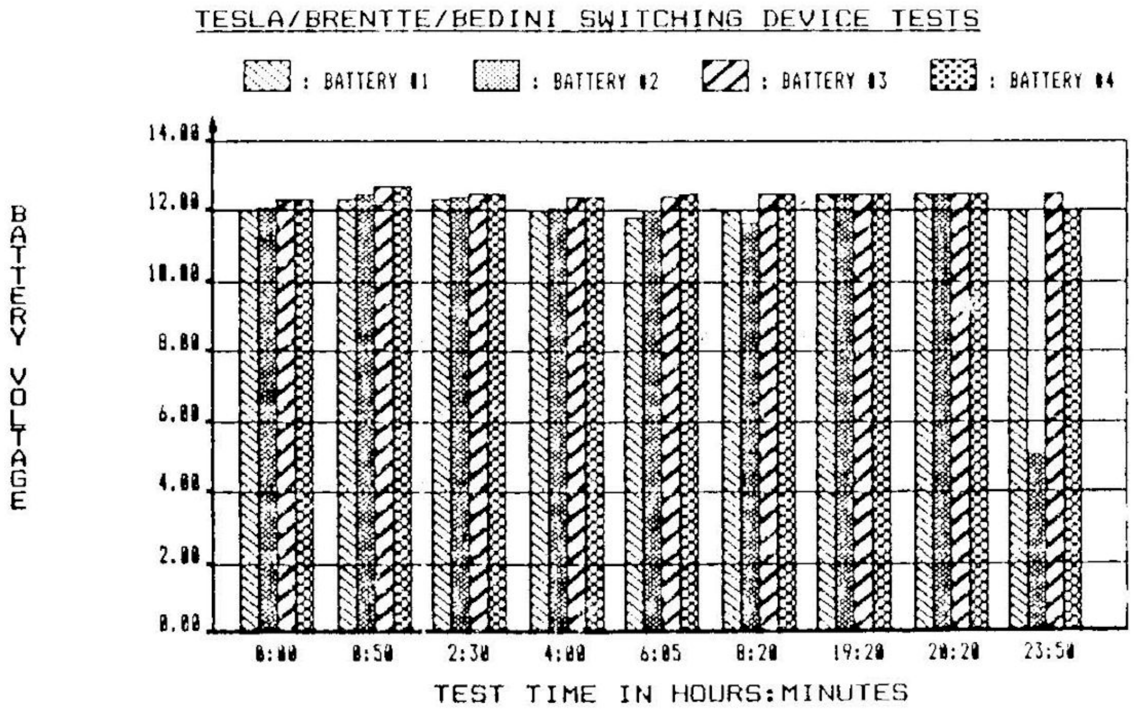
EVENT P 3:00 pm all lights again out, voltage measurements taken. The low voltage of battery #2 - marked with (*) in the **TABLE 3** - is most probably caused by the back EMF from the transformer. The ideal tranformer would be an inverter transformer 10 V to 110 V.

The summary of this test can be seen in **TABLE 3** which is a direct continuation of **TABLE 2**.

TIME	8:30pm	9.15	10:30	11:05	11:30	10:30am	11:30	3:00pm
EVENT	I	J	K	L	M	N	O	P
VOLTAGE								
BATT.#1	11.7	11.8	12.0	11.8	12.8	12.5	12.5	12.8
BATT.#2	12.1	12.8	12.1	11.9	11.7	12.5	12.5	5.8 (*)
BATT.#3	12.4	12.4	12.4	12.5	12.5	12.5	12.5	12.5
BATT.#4	12.4	12.5	12.5	12.4	12.5	12.5	12.5	12.0

TABLE 3 CONTINUATION OF MEASUREMENTS SHOWN IN TABLE 2

The total test run is summarized in **GRAPH 1** on the following page. In this graph I show the voltages of all batteries over the test time in hours.



GRAPH 1 TESLA/BRENTTE/BEDINI SWITCHING DEVICE TEST SUMMARY

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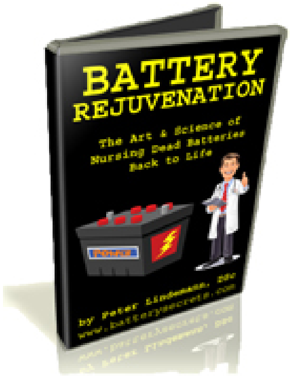

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